AD-A173 332 VCTD (VELOCITY CONDUCTIVITY TEMPERATURE DEPTH) RESULTS· 1/2
GULF STREAM FRONT (U) NAVAL OCEAN RESEARCH AND
DEVELOPMENT ACTIVITY NSTL STATION MS K D SAUNDERS
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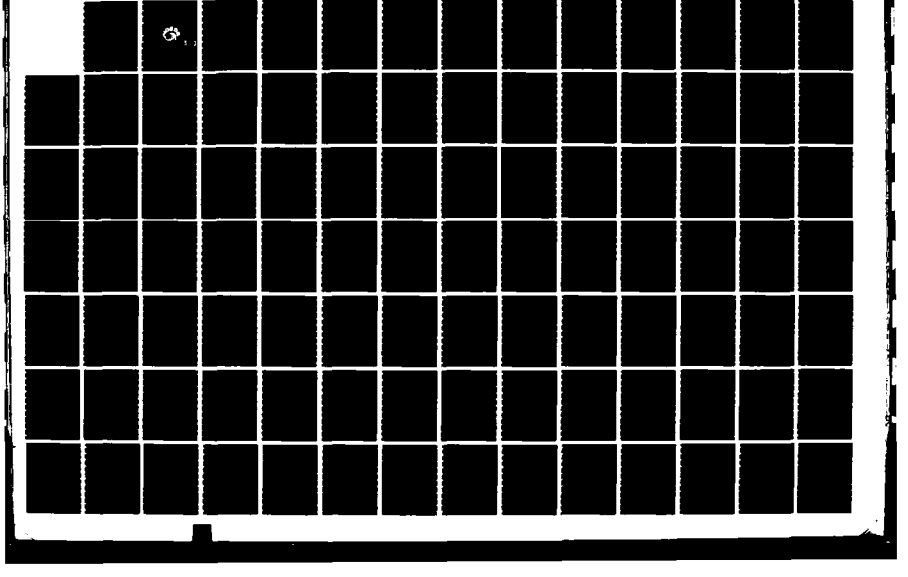

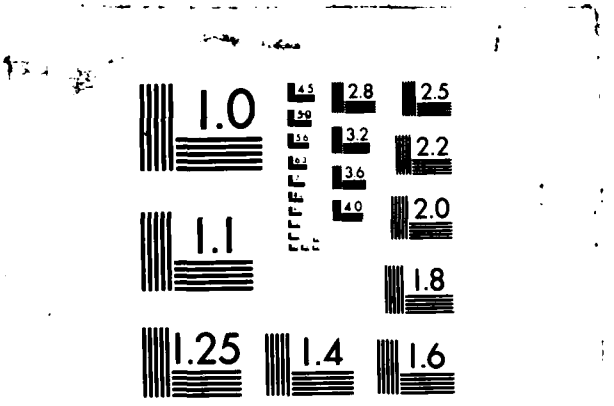

NORDA Technical Note 229

Naval Ocean Research and
Development Activity
NSTL, Mississippi 39529

VCTD Results: Gulf Stream Frontal Stream Study, 1985, Chemical Dynamics in Ocean Frontal Areas Study

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July 1986

ABSTRACT

The first cruise to study chemical (and biological) dynamics in ocean frontal regions was conducted in the spring of 1985 off the east coast of the United States. The NORDA Velocity, Conductivity, Temperature and Depth profiler (VCTD) was employed to collect basic physical oceanographic measurements in the upper ocean. This report presents the data obtained by the VCTD during this cruise.

ACKNOWLEDGMENTS

The author gratefully acknowledges the assistance of all those on the OSV ANTELOPE who helped with collecting the data and those at NORDA who have assisted in processing these data. Among those whom I especially wish to thank for their assistance are Steve Sova, Denis Wiesenburg, Robert Arnone, Charles Rein, and Bob Fitzgerald.

This project was supported under program element 61153N, project number 03105, Dr. H. Eppert, manager.

OVERVIEW

The Velocity, Conductivity, Temperature, Depth (VCTD) profiler is an instrument which was developed primarily to study finescale variations of temperature, salinity and velocity in the upper ocean. It was employed in the first cruise of the Dynamics of Chemical Fronts project to provide the physical oceanographic background data in a strong ocean frontal region that will aid in interpreting the chemical and biological measurements.

Before the main work of the cruise was to have begun, the VCTD, along with other equipment, was to have been tested during a test station (Station 0). There had been some problems prior to this cruise with the conductivity section of the deep profiler, and this was tested first, as the second profiler was to have been used for the relatively shallow work envisioned. Along with the testing of the shallow profiler, the control system for the motion compensating winch was to have been tested. The first test was completed successfully, but the second profiler and the winch could not be tested due to the rapidly increasing wind and seas.

Before the first station could be taken with the VCTD, the power amplifier circuit for the winch control failed and the winch had to be run without motion compensation. The observed instrument velocities were therefore the sum of the true oceanic velocities, the ship drift and the wave-induced instrument velocity. The plotted velocities have been corrected for ship drift and are therefore absolute velocities of the water. The ship drift was nearly constant over the period of a single cast and caused no problems in the subsequent analysis. The wave-induced motion, however, could only be partially removed by filtering the signal with a low-pass filter whose cutoff frequency is below the primary wave/heave frequency. The filtering operation reduced the effective resolution of the VCTD to about a 10 m scale; finer scale features were lost.

The VTCD was deployed on stations 1-6, 9 and 11. Station 9 was prematurely terminated when the wire jumped the block. The winch failed during station 11 due to a shorted control valve coil and could not be repaired at sea. Good velocity data were obtained for stations 1-4 and 6 (after filtering). Good CTD data were obtained for stations 1-6. The observations for each station are summarized below.

STATION 1.

The first (non-test) station was located seaward of the frontal zone. The water mass was characterized by warm, saline water overlying somewhat fresher, cooler water. There was an approximately isothermal layer down to about 40 m and an almost isohaline layer, slightly increasing in salinity, between the surface and about 110 m. Just below the isothermal layer, there was a small, but very clear "s"

shaped salinity minimum overlying a salinity maximum, indicating a possible weak intrusion. Above the thermocline, the water column was stable to both direct and double diffusive effects as indicated by the a Turner angle between -pi/2 and 0. Below the thermocline, the Turner angle varied between about -3/8 pi and - 3/4 pi. There were about 8 layers where the angle was less than about -5/8 pi, indicating the possibility of salt-fingering regimes.

The current (with respect to the ship) decreased from about 0.8 m/s near the surface to about 0.5 m/s near 70 m, increasing again to about 0.7 m/s near 100 m and decreasing again to about 0.4 m/s near 130 m and below. The direction of the current remained approximately constant with depth.

STATION 2.

Station 2 was taken north and slightly west of the first station. The water mass in the upper 200 m had changed very significantly over a distance of about 20 nautical miles. In general, the water was considerably colder (about 6 deg. C at 100 m) and fresher (about 0.9 psu at 100 m). The near surface waters were about 0.6 kg/m**3 denser at station 2 than at station 1.

There appears to be an intrusion of warm, saline water near the surface, down to about 40 m and a second, weaker intrusion of warm, saline water between about 55 and 95 m (based on a comparison with station 3). Between about 15 and 30 m there appears to be a strong salt-fingering regime. Directly below this area, the water column appears to be stable down to about 70 m. Between 70 and 100 m, the stability changes from a convective regime to an unstable direct regime to salt-fingering to stable. Below about 100 m, the water column is alternately stable and salt-fingering.

The surface instrusion may be related to a very strong shear zone between 10 and 40 m. The speed in this layer changed from 0.8 m/s to about 0.35 m/s. The direction remained about the same over this layer. Below 40, the speed of the current decreased slowly to about 0.3 m/s, with small changes in the direction of the flow.

STATION 3.

Station 3 was taken about 3.8 Nmi WNW from station 2 about 2 hours later. The warm, saline intrusion had disappeared from the record: the near surface water was about 6 deg C cooler and the salinity was about 1.3 psu lower than it had been at station 2. Below about 100 m, the profiles of temperature and salinity agreed quite well for both stations. There are temperature and salinity inversions near 60 and 80 m, indicating possible salt-fingering and convective regions in proximity. Between 80 and 120 m, the water column is stable and below that region, a mixed regime of stable and salt-fingering is observed.

The velocity structure was very different between these stations. At station 3, the strong shear layer had almost completely disappeared. Instead there was a weak shear of decreasing from about 0.5 m/s near 10 m depth to about 0.4 m/s at 100 m, and to about 0.32 m/s near 200 m. As before, the direction of the current remained nearly constant with depth.

STATION 4.

Station 4 was taken about 4 1/2 hours after station 3 and about 26 Nmi NNW from station 3. Below about 100 m, the temperature and salinity profiles agreed well with those of the previous two stations, while above 100 m, the station 4 water was warmer and more saline, though not warm as the water at station 2.

The Turner angle plots for station 4 show evidence of salt-fingering possibilities over most of the water column with the exception of six to seven stable layers centered near 35, 70, 90, 140, 190, 270 and 300 m.

The velocity profiles at station 4 indicated stronger shears than were seen at station 3, which may account for the weak intrusion near the surface of warm, saline water.

STATION 5.

The fifth station was taken almost due east from station 4 and exhibits almost the same temperature and salinity structure.

The velocity data were badly contaminated with ship motion during this station and it is not yet clear if they can be recovered from the noise.

STATION 6.

The last usable VTCD station was taken SE from station 5 and ENE of stations 2 and 3 on the same day as those stations. There was an intrusive region of warm, saline water extending down to about 75 m and a much weaker intrusion between about 80 and 130 m (the intrusions are referenced to station 3). Below about 70 m, the Turner angle plots indicate regions of both salt-fingering and absolute stability. Above this region, there is a region of possible salt-fingering activity between about 35 and 55 m and also near about 15 m.

The intrusive features were separated by a strong salinity and temperature minimum located at about 80 m. The profiles were rather smooth during the first cast, but several strong steps in the temperature and salinity profiles were apparent below and one step above the temperature-salinity minimum were seen during the second cast. The third cast saw the development of more steps below the minimum. The single step above the minimum has turned into two steps and a third step had formed above those two.

The velocity profiles indicated a moderately strong shear between the surface and 100 m, the speeds ranging from about 0.75 m/s near 10 m to 0.45 m/s near 100 m. As in the previous stations, the direction remained essentially constant with depth.

STATION POSITIONS AND TIMES

STATION NUMBER	CAST ID	GROUP NO.(*)	DATE (JD)	LAT.	LONG.
1	4	4	120.801	37.500	-72.752
	5	5	120.804	37.502	-72.753
2	2	6	120.996	37.845	-72.873
	3	7	121.006	37.845	-72.873
	4	8	121.016	37.845	-72.873
3	2	9	121.202	37.880	-72.940
	3	10	121.211	37.880	-72.942
	4	11	121.221	37.878	-72.942
4	2	12	121.414	38.283	-73.150
	3	13	121.424	38.282	-73.153
	4	14	121.433	38.280	-73.158
5	2	15	122.685	38.355	-72.690
	3	16	122.694	38.343	-72.703
	4	17	122.703	38.342	-72.707
6	3	18	122.959	38.100	-72.510
	4	19	122.967	38.107	-72.497
	5	20	122.978	38.105	-72.493

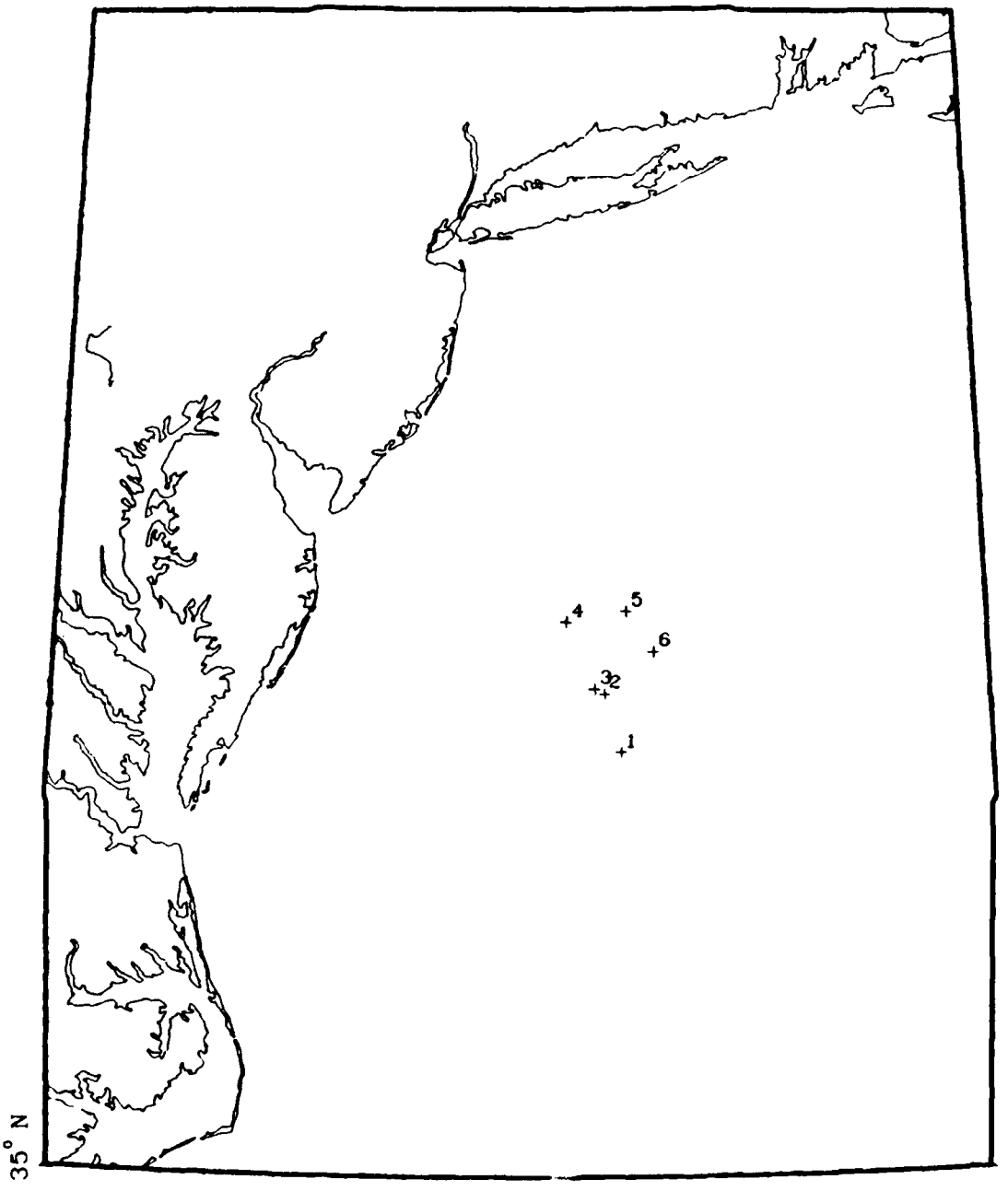
(*) Note: The velocity profiles were recomputed and have a group number 3 less than that noted here (e.g., Station 1, cast 1 has a group number of 4, except for the velocity plots, which both have a group number of 1.

NOTES ON THE STATION PLOTS

1. *Ship velocity corrections have been applied to all station velocity data except for station 6 (no position data were available.)*

2. *The Julian Date on the plots for the last 2 groups of station 6, groups 19 and 20, should read 122, not 125.*

STATION LOCATIONS, FRONTS 85



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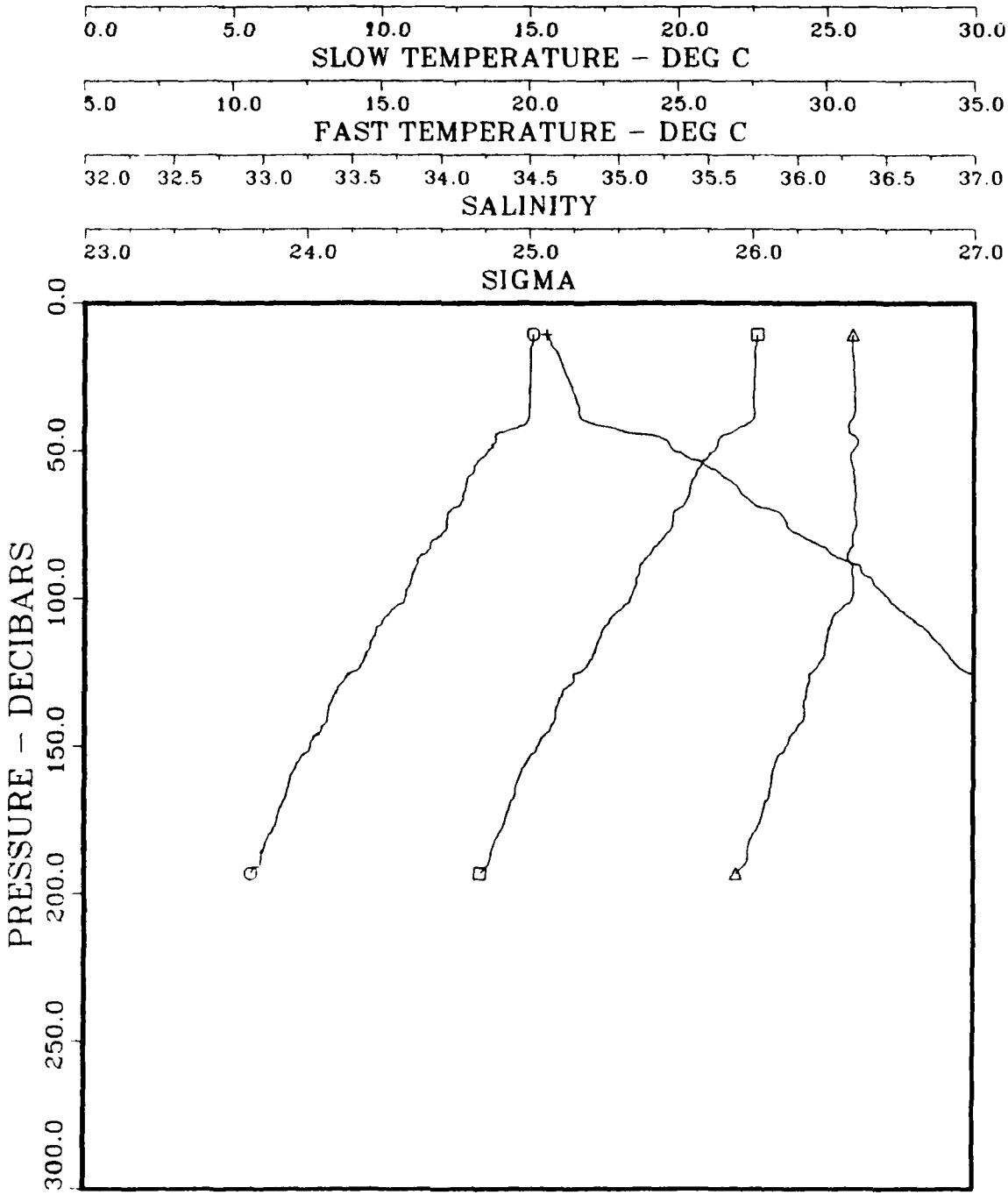
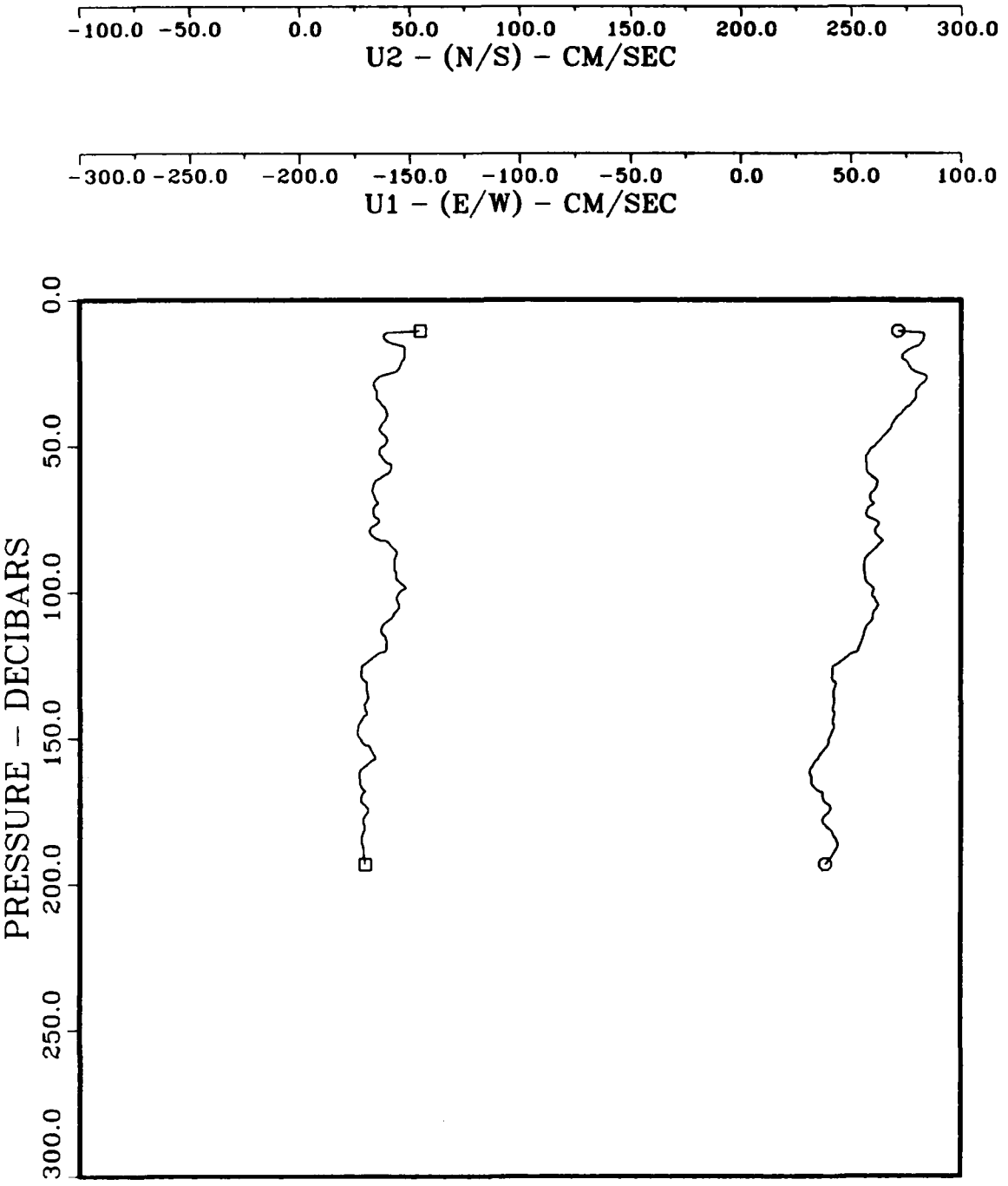


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	4
JULIAN DATE	120.8010
LATITUDE	37.500
LONGITUDE	-72.752

LEGEND

□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
+ = SIGMA



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LONGITUDE	-72.752

LEGEND
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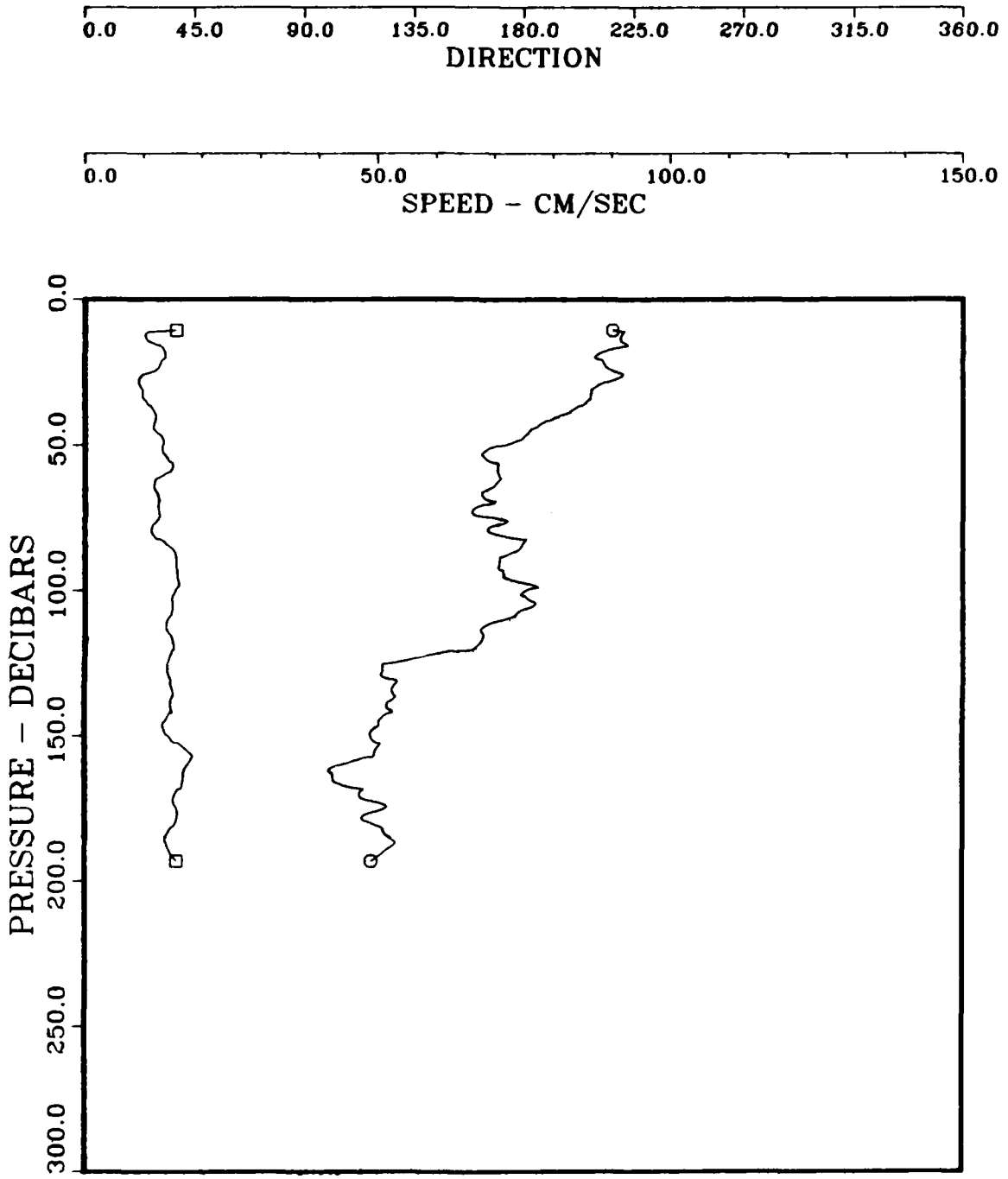

DYNAMICS OF CHEMICAL FRONTS - 1985

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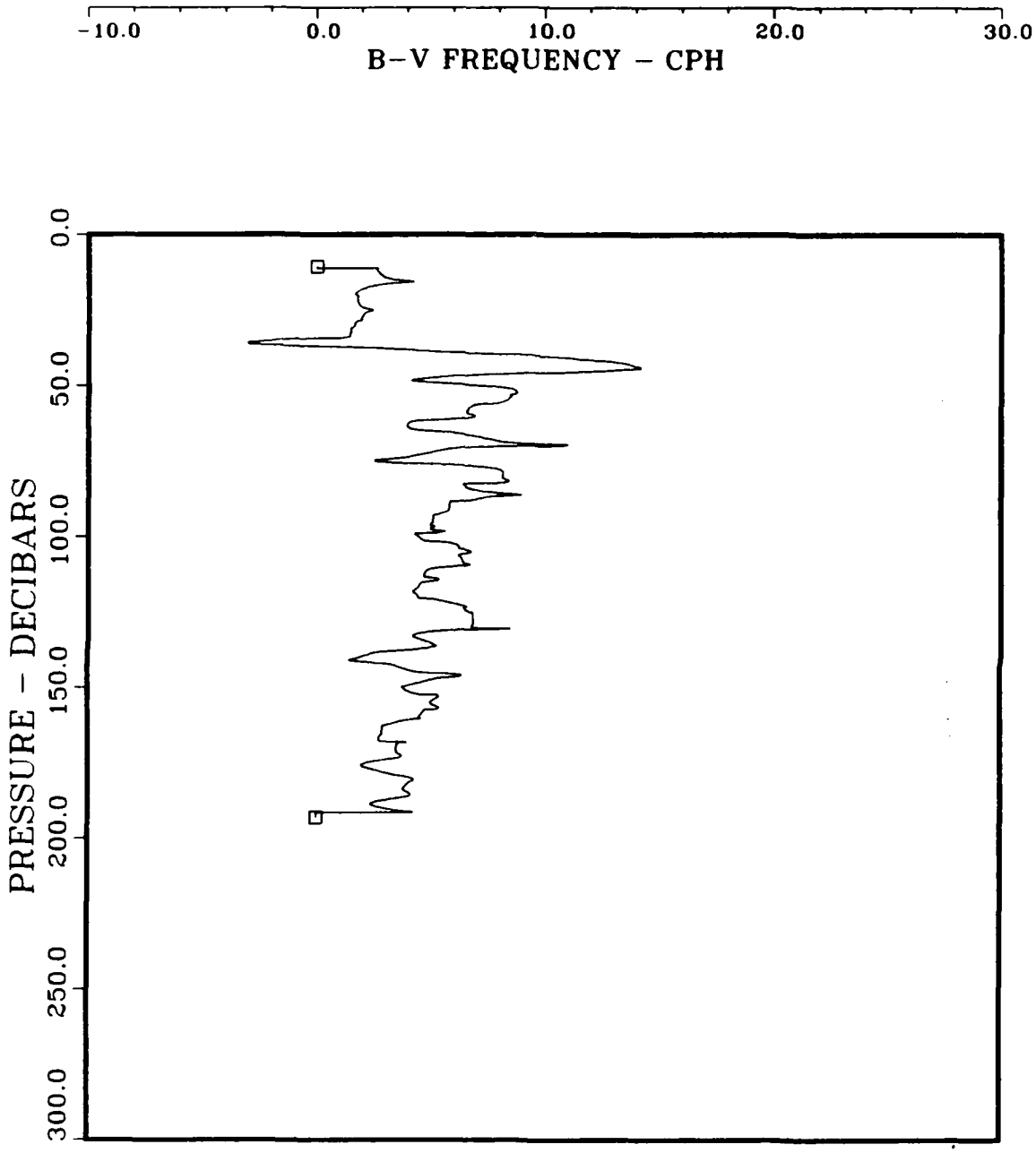

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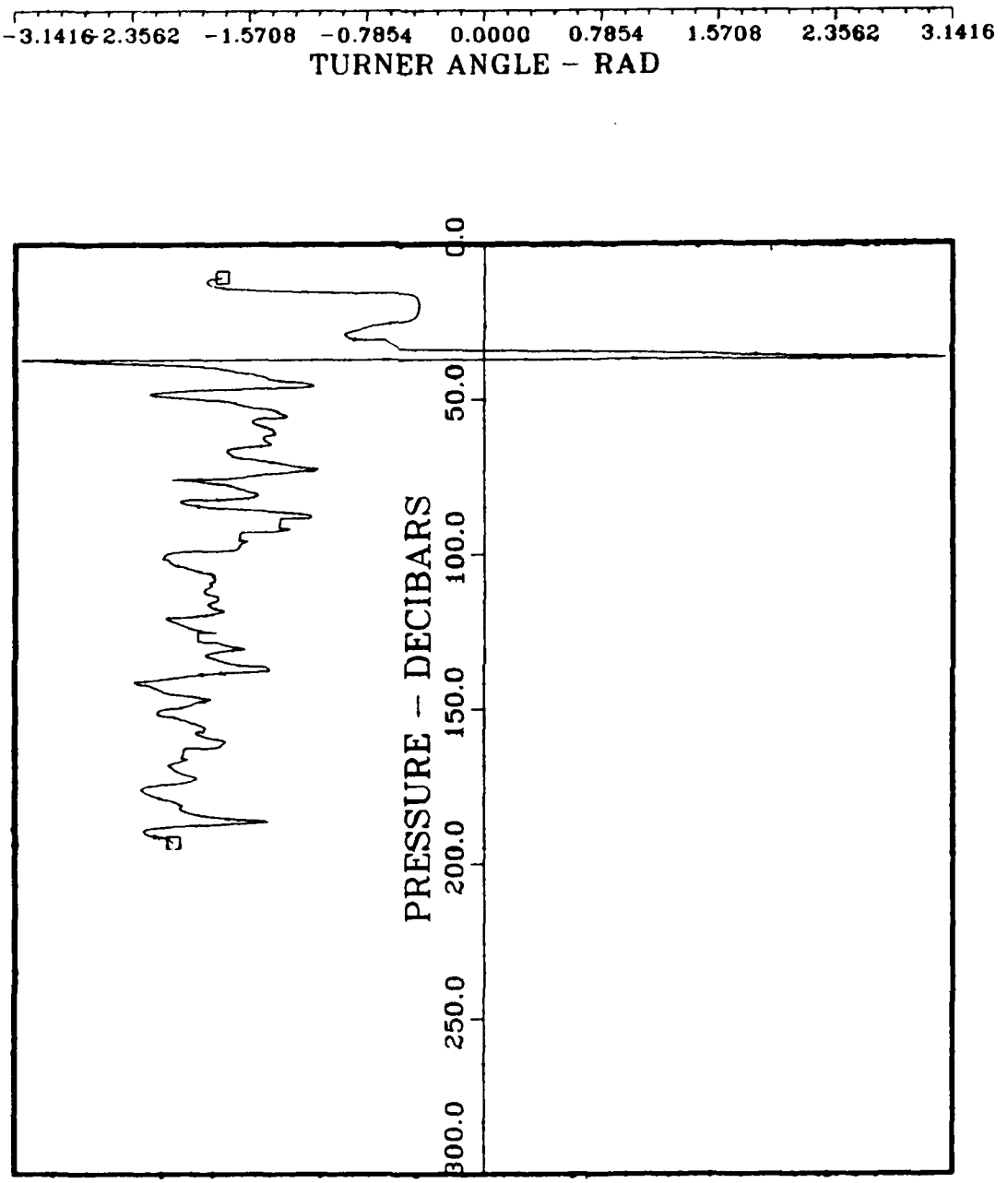

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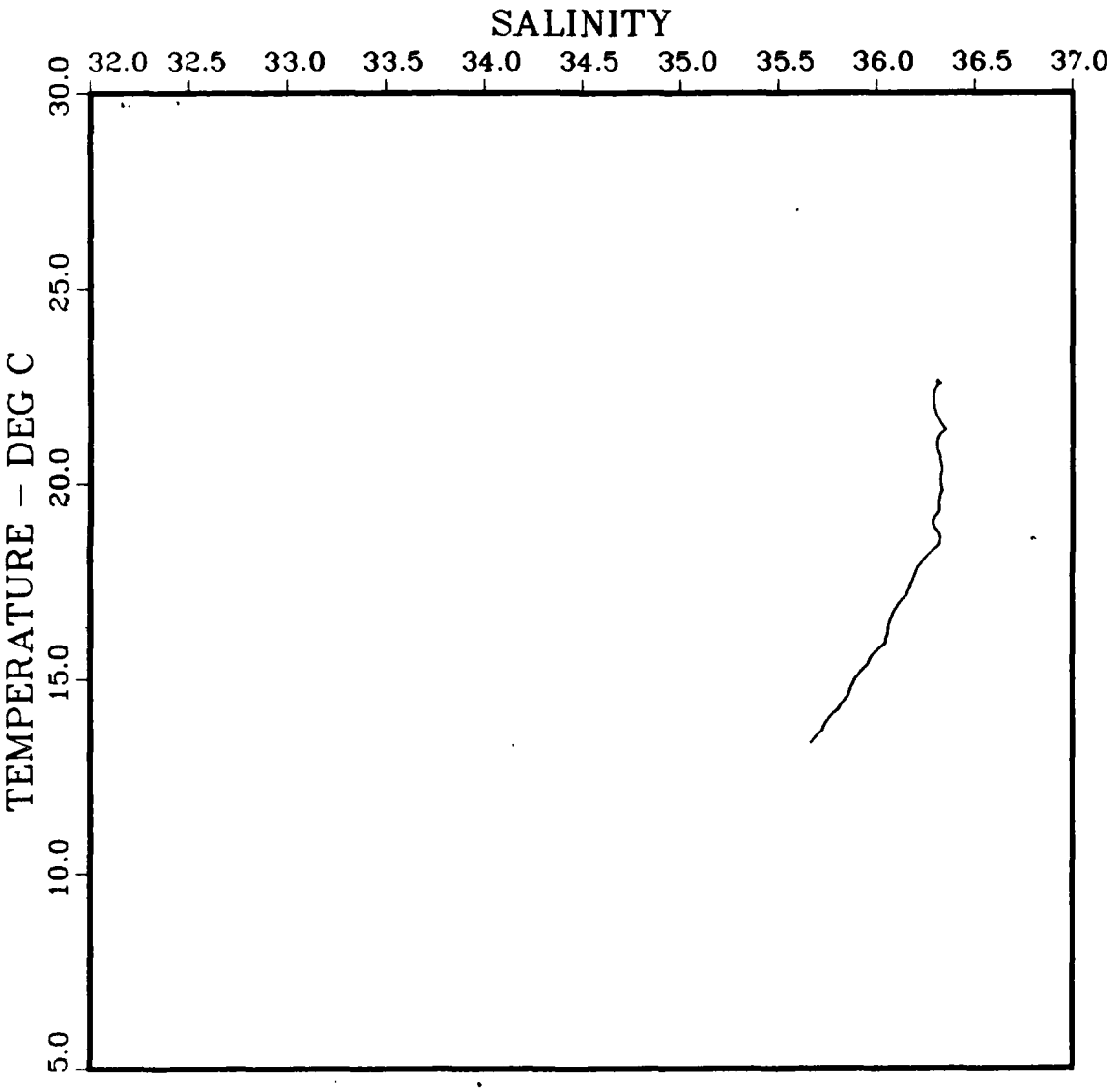

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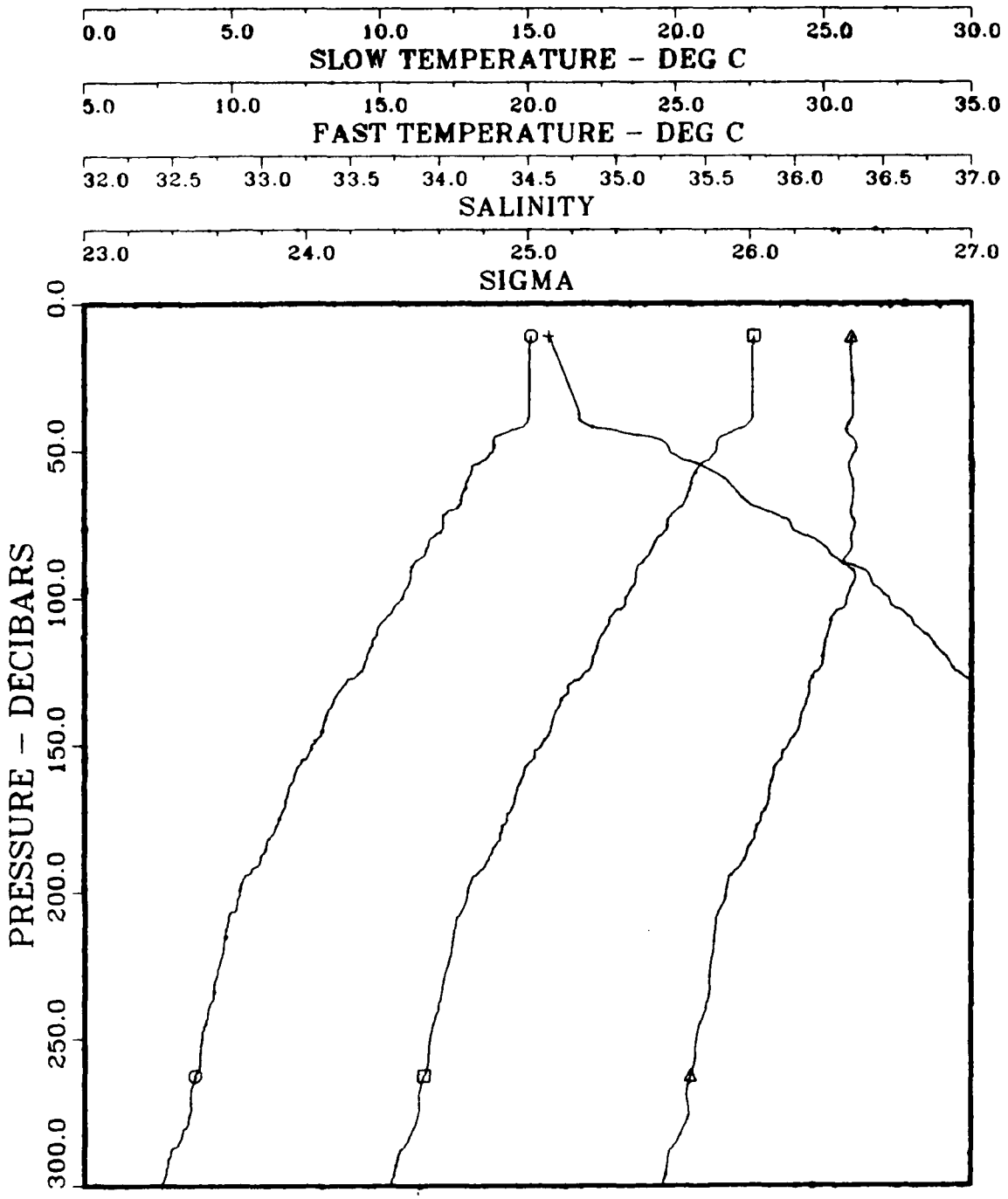

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GROUP NUMBER	5
JULIAN DATE	120.8140
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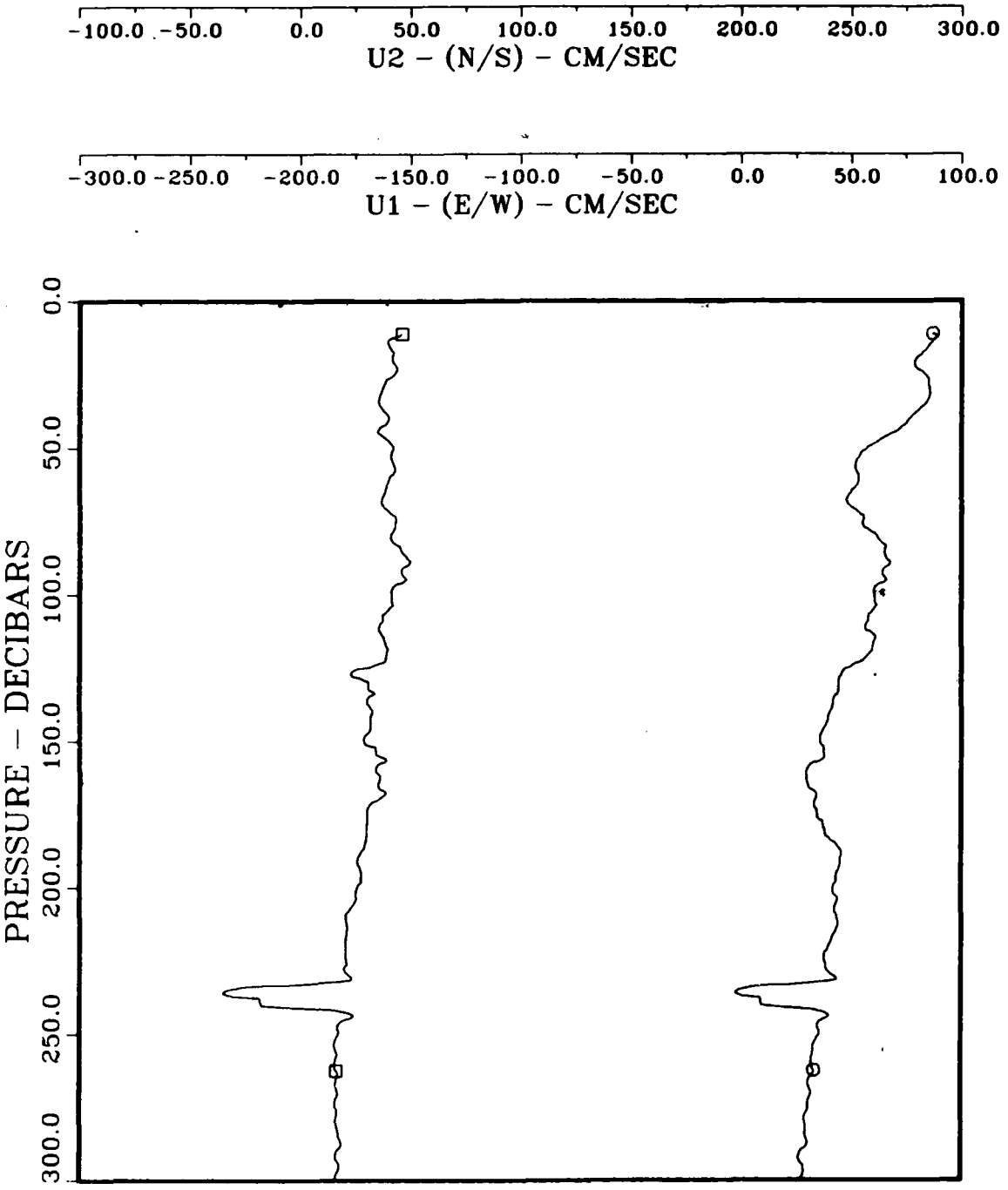

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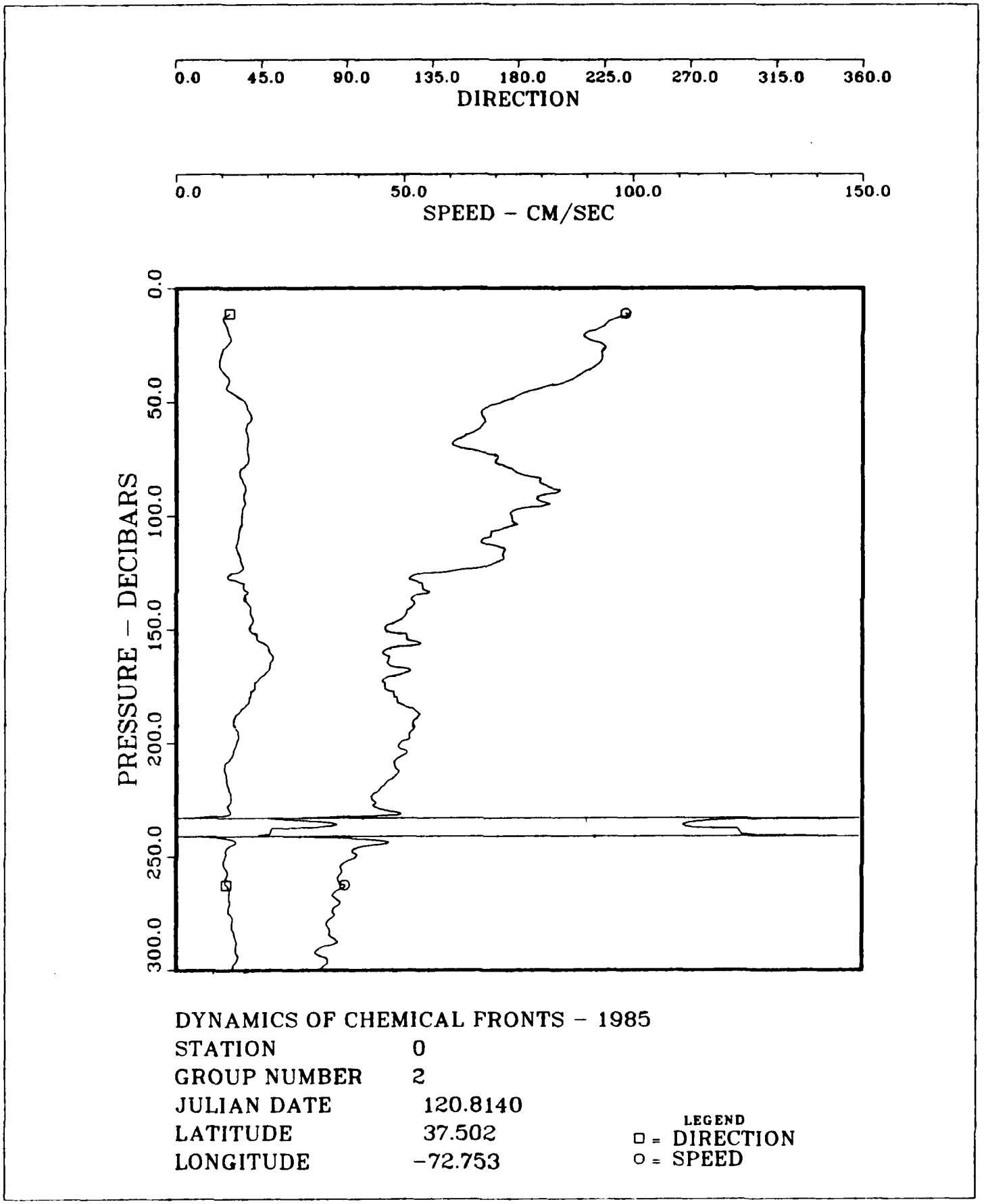

DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
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LONGITUDE	-72.753

LEGEND
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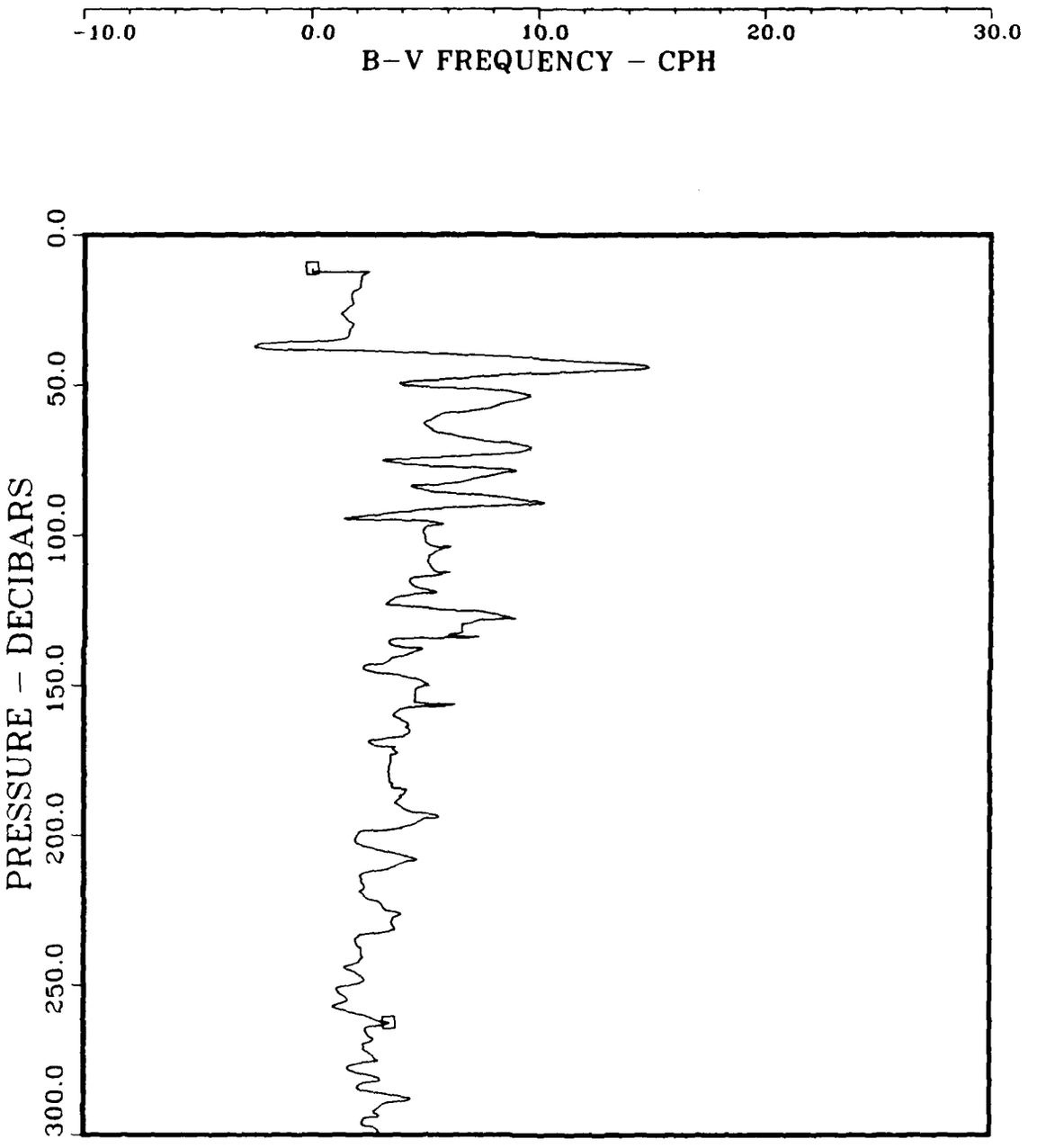

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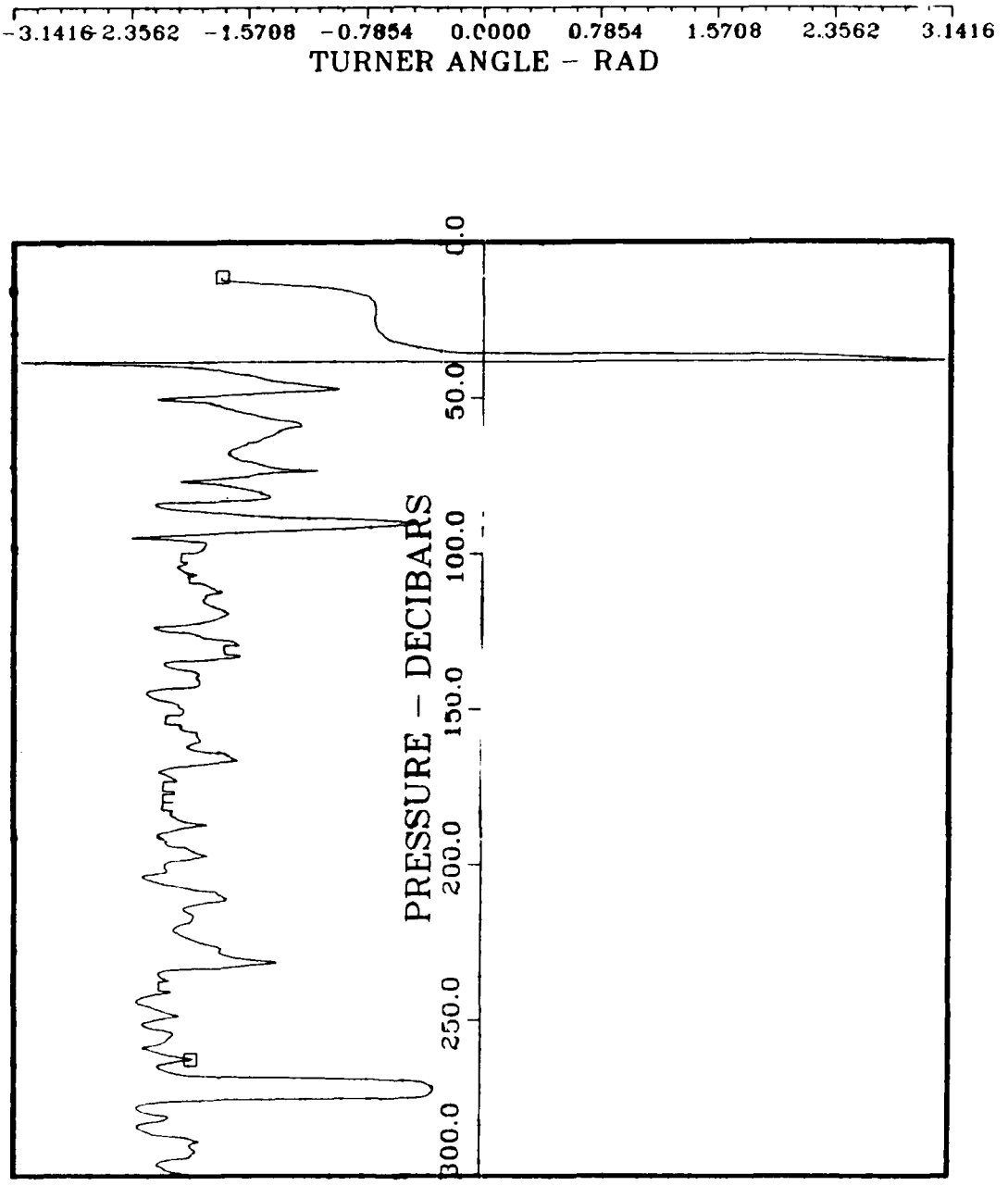

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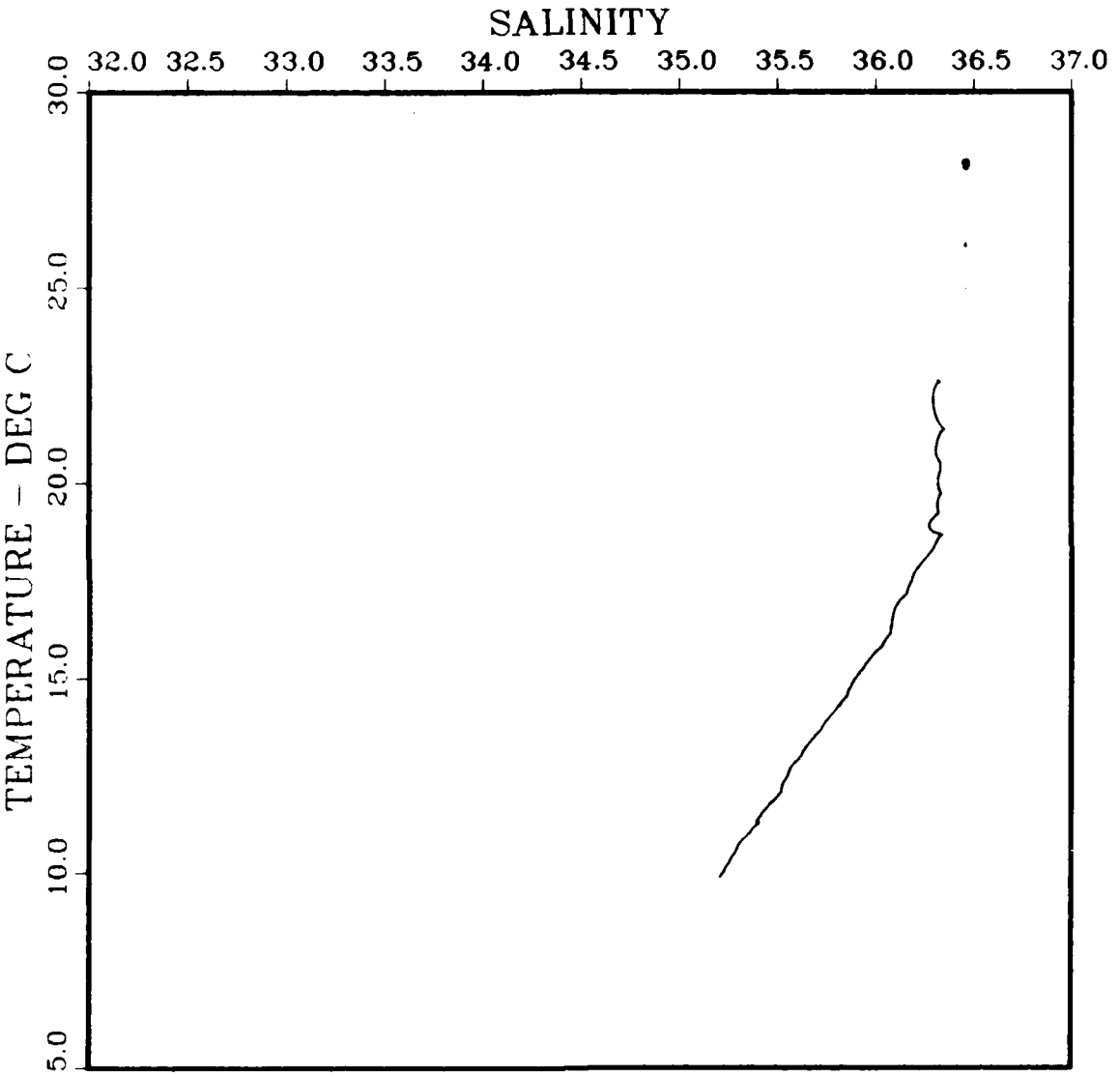

DYNAMICS OF CHEMICAL FRONTS

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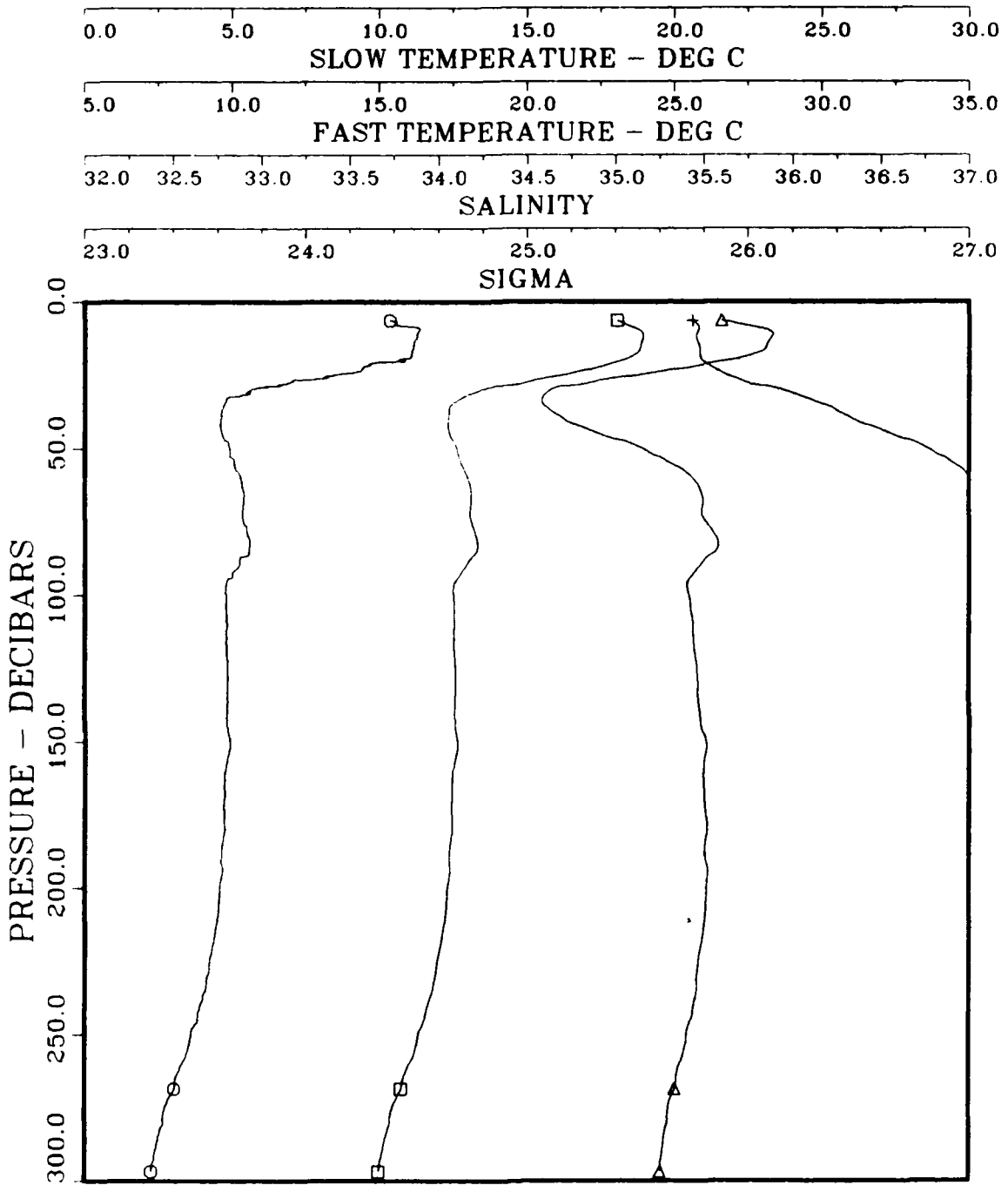
STATION 2



DYNAMICS OF CHEMICAL FRONTS – 1985

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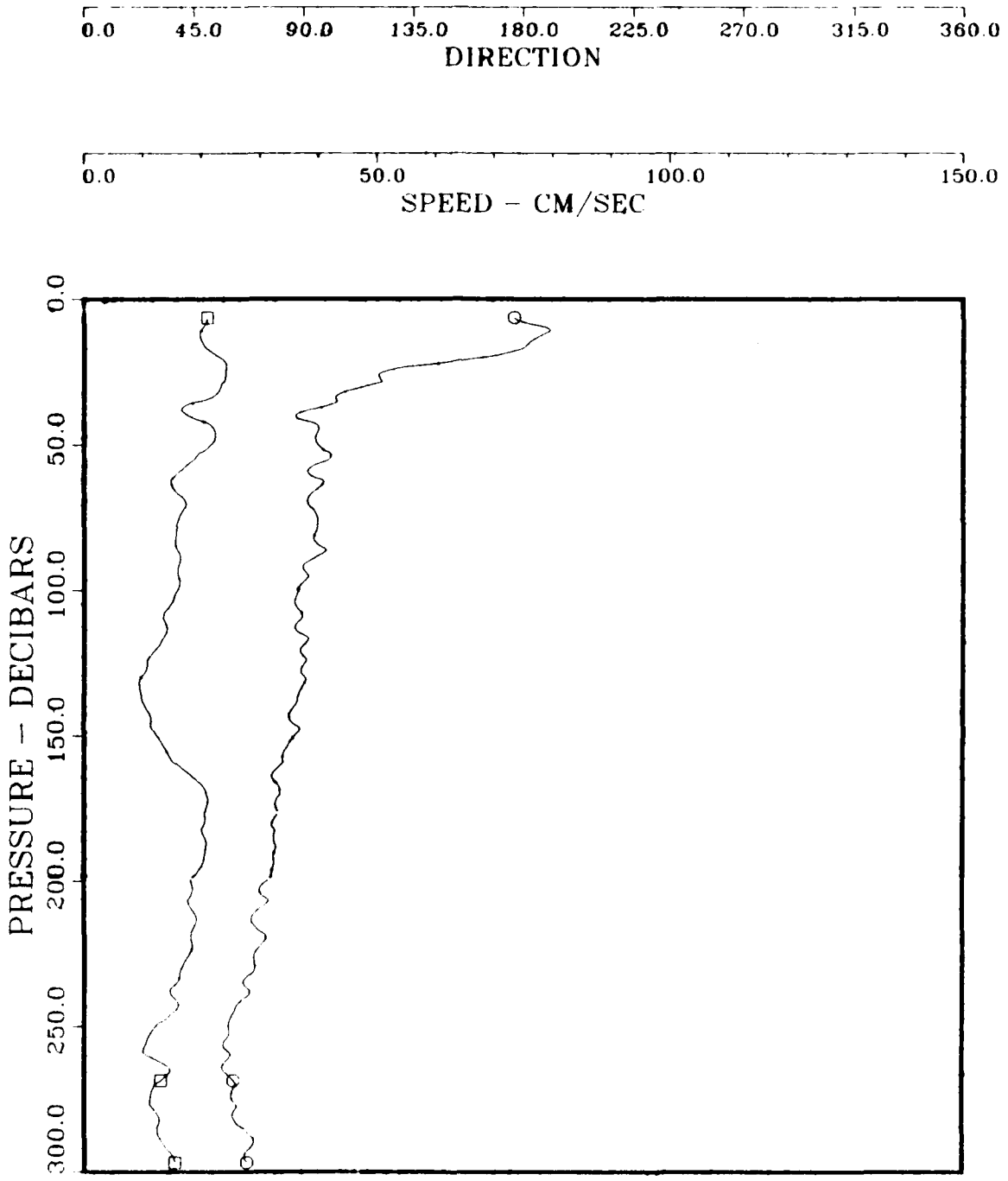

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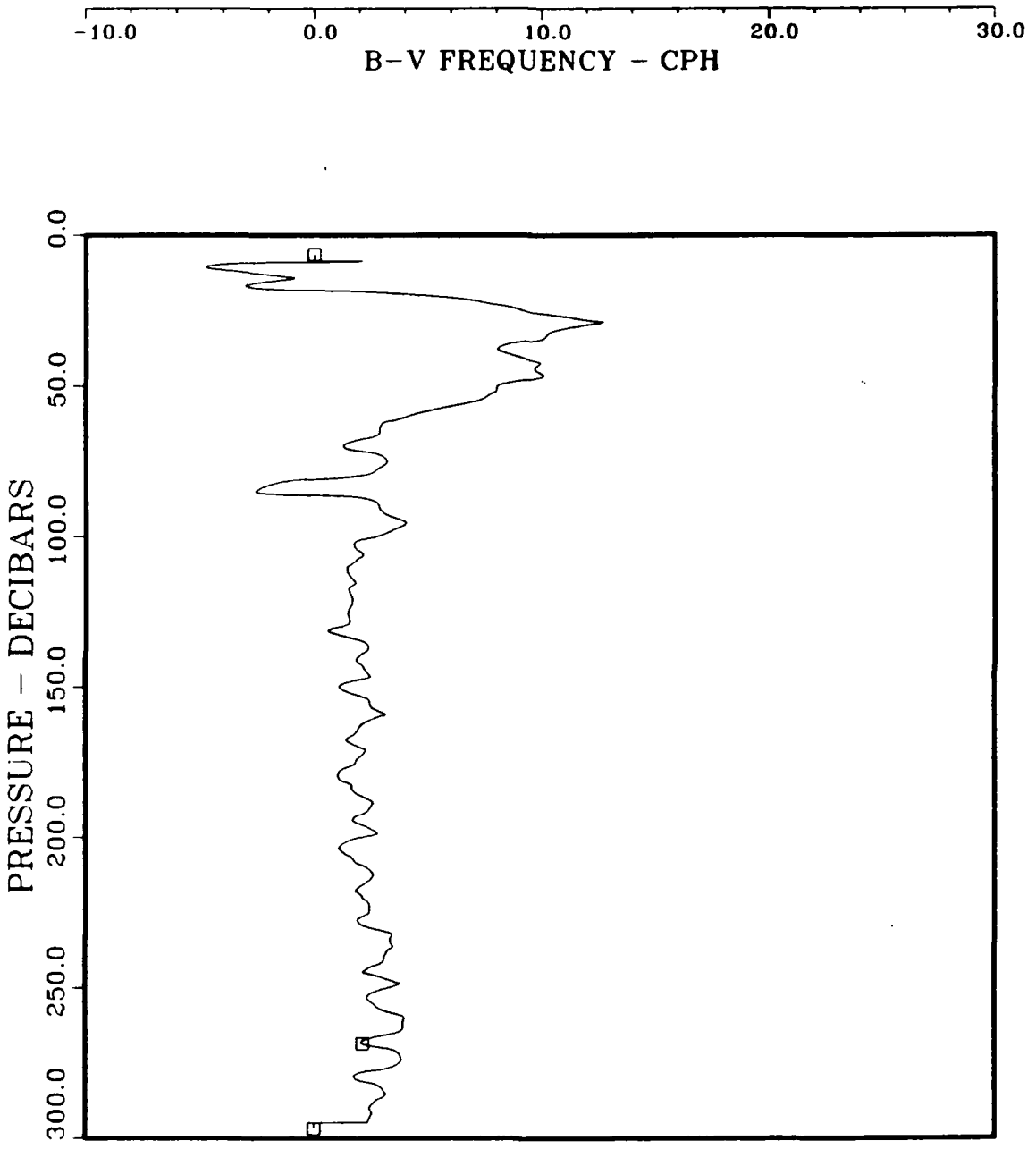

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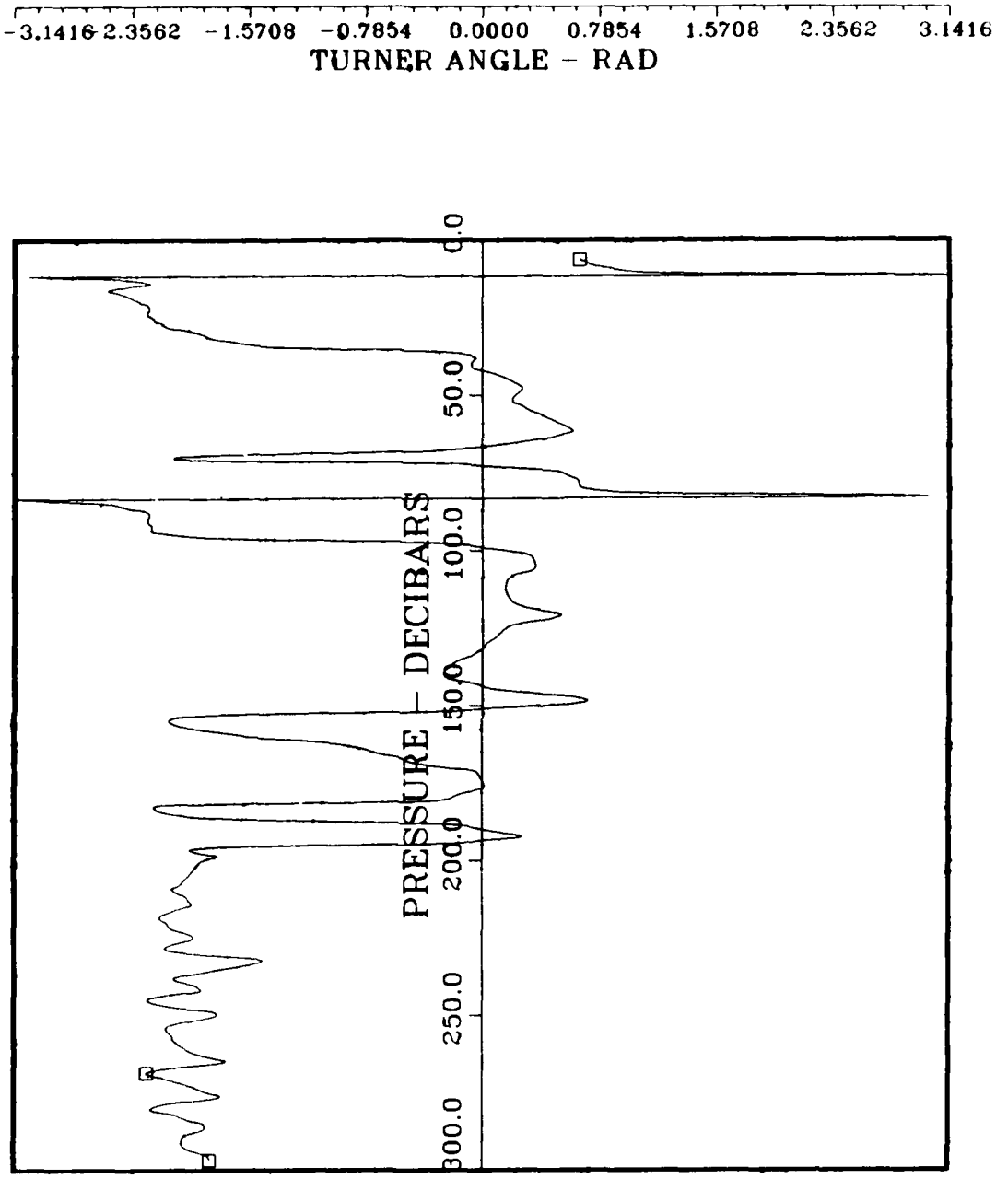

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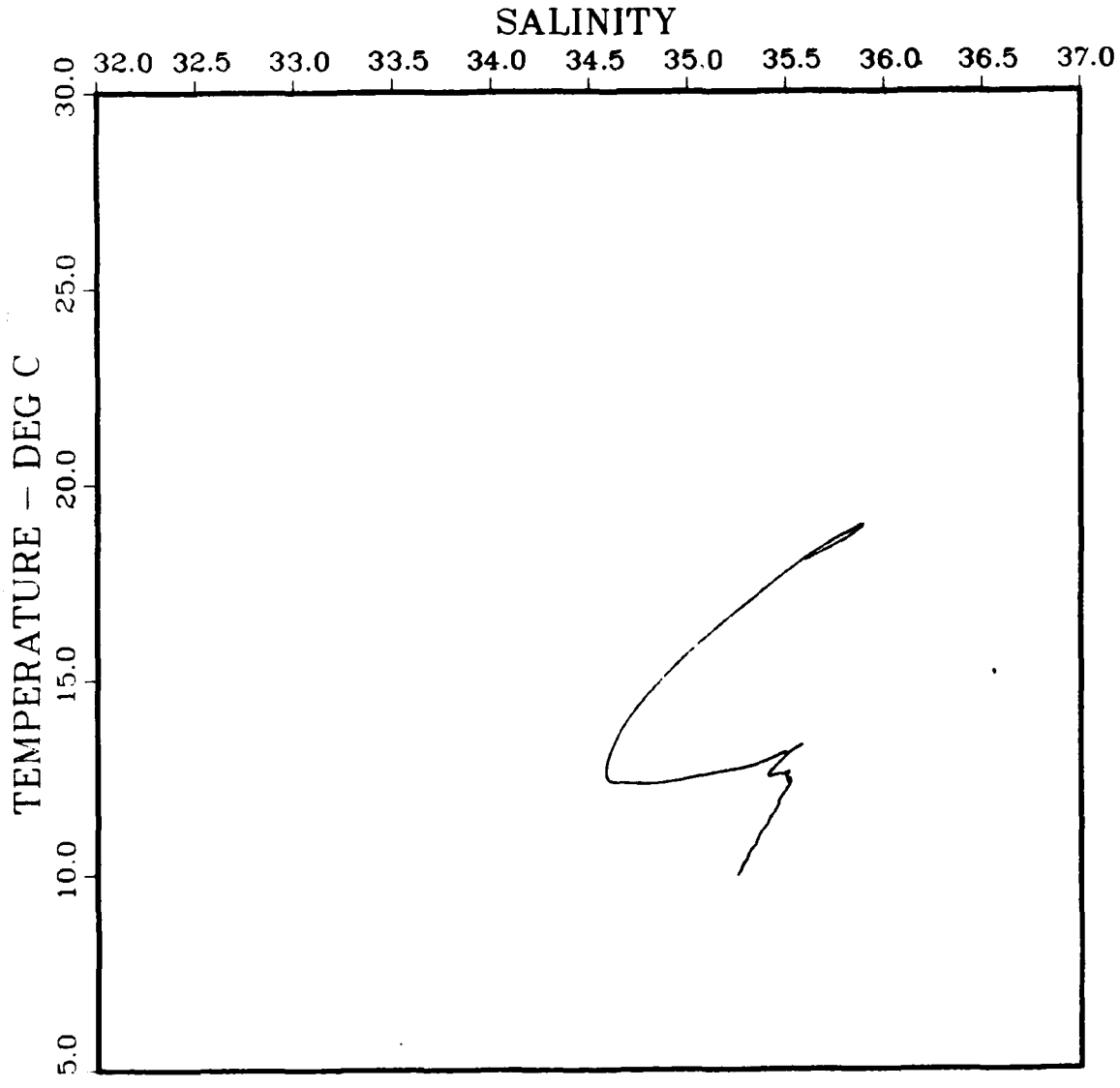

DYNAMICS OF CHEMICAL FRONTS

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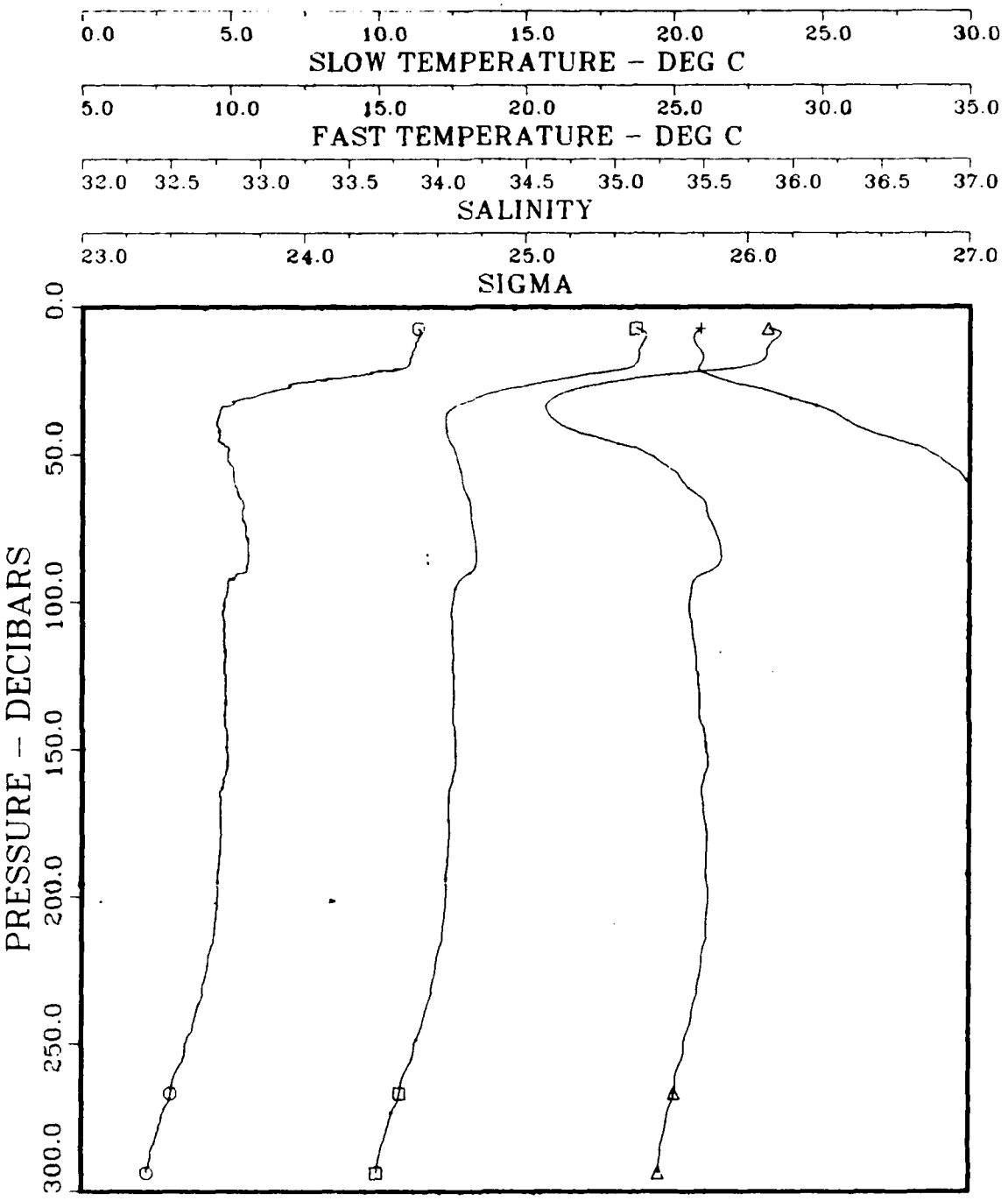

DYNAMICS OF CHEMICAL FRONTS – 1985

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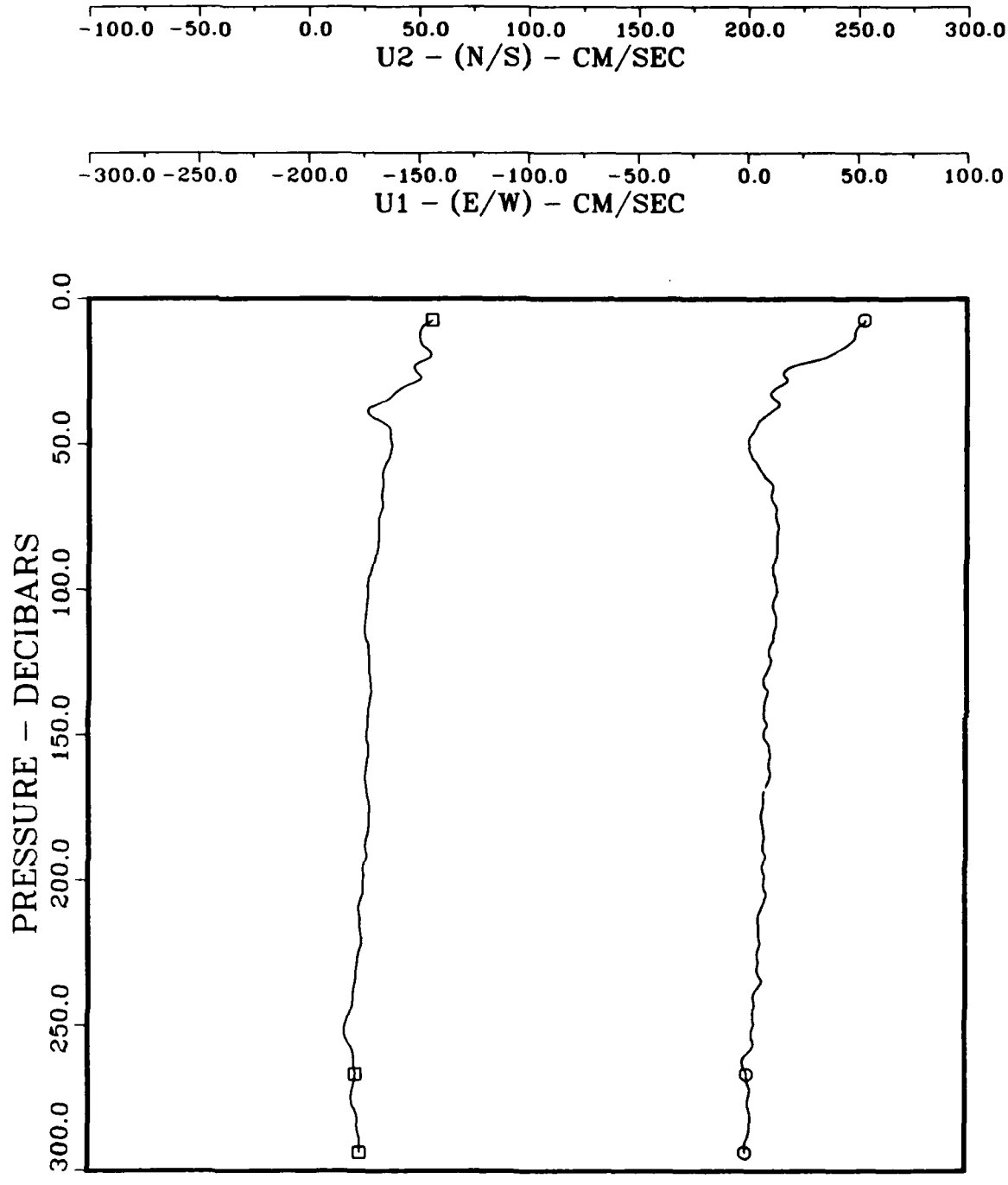

DYNAMICS OF CHEMICAL FRONTS – 1985

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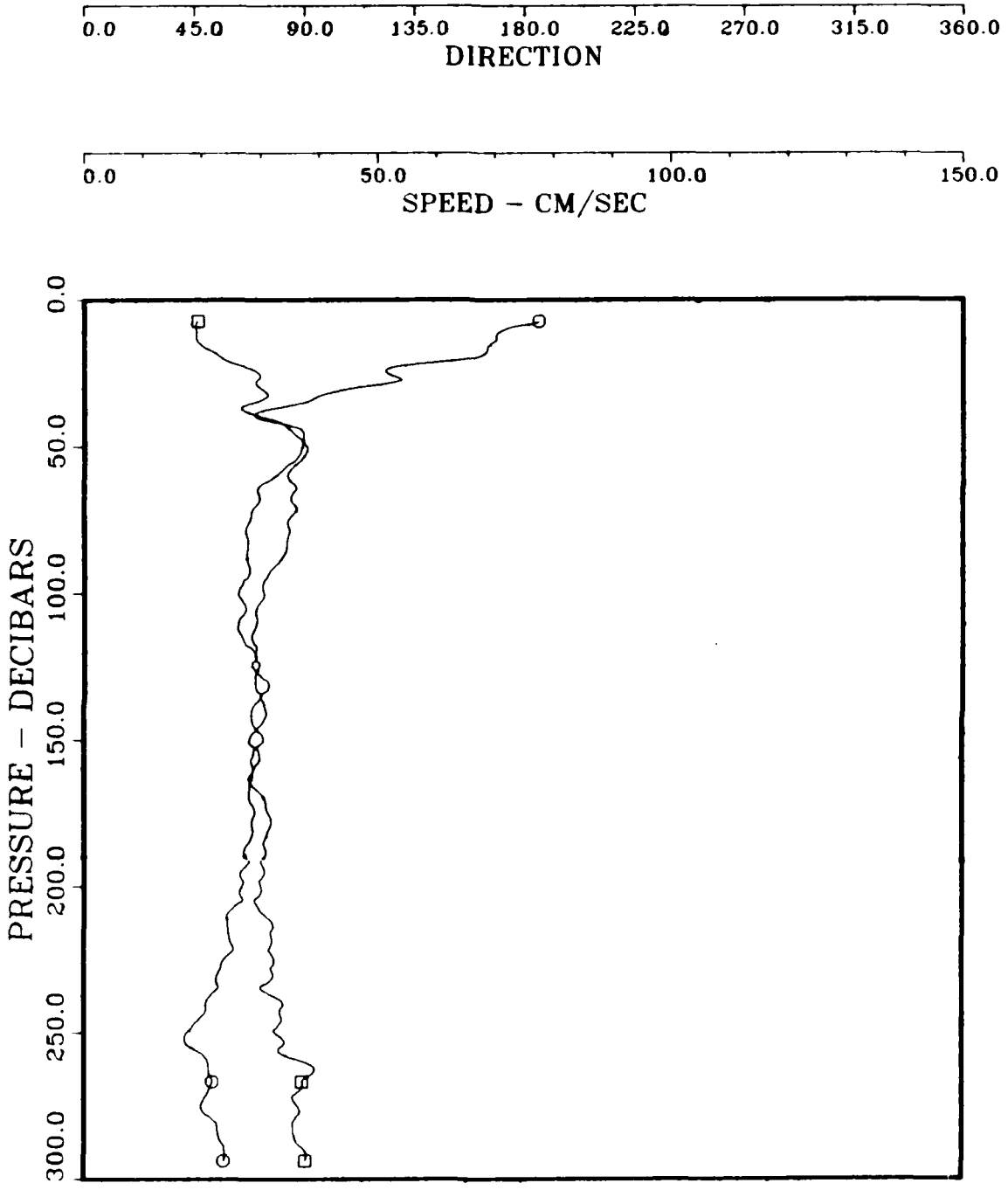

DYNAMICS OF CHEMICAL FRONTS - 1985

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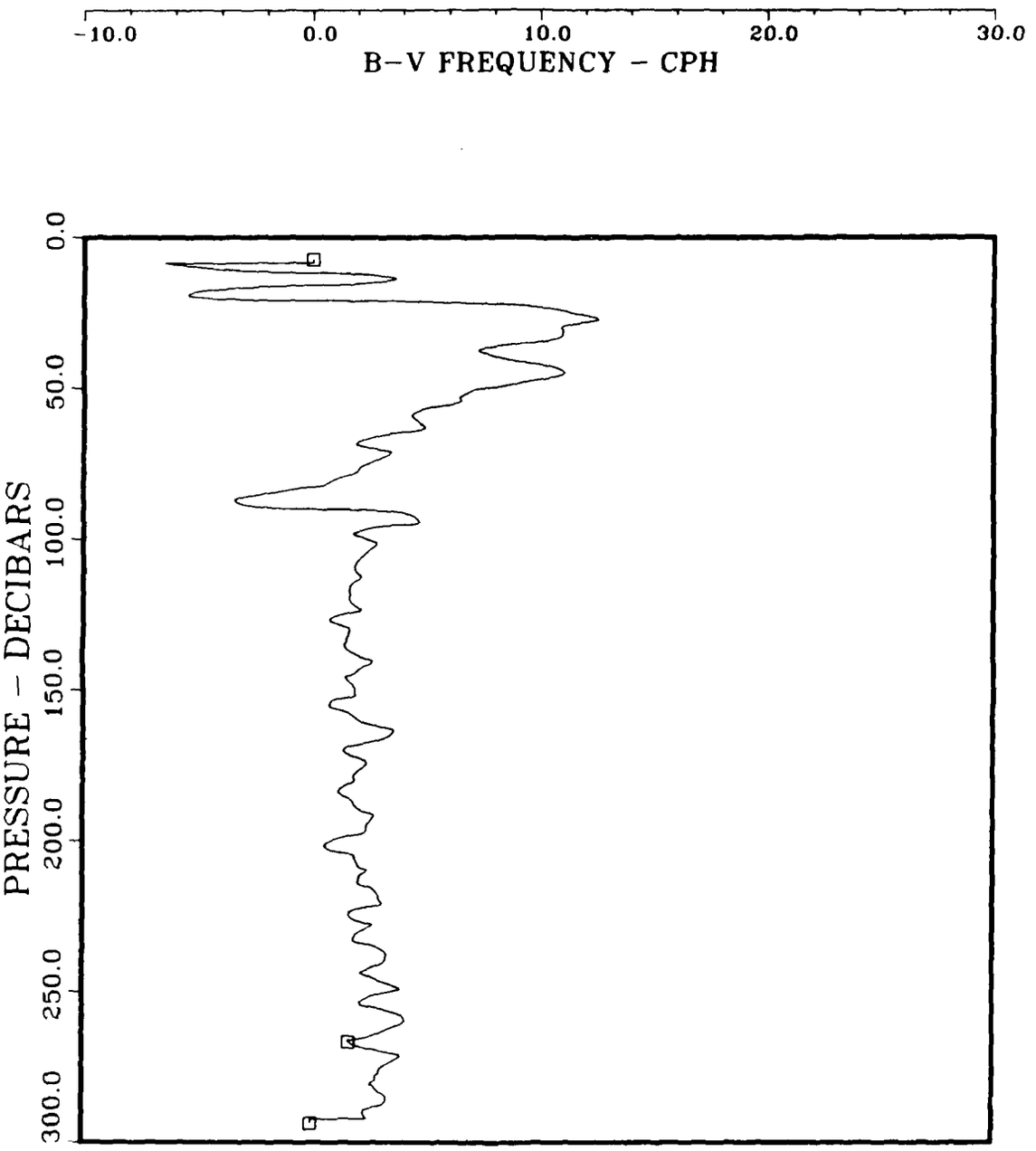

DYNAMICS OF CHEMICAL FRONTS - 1985

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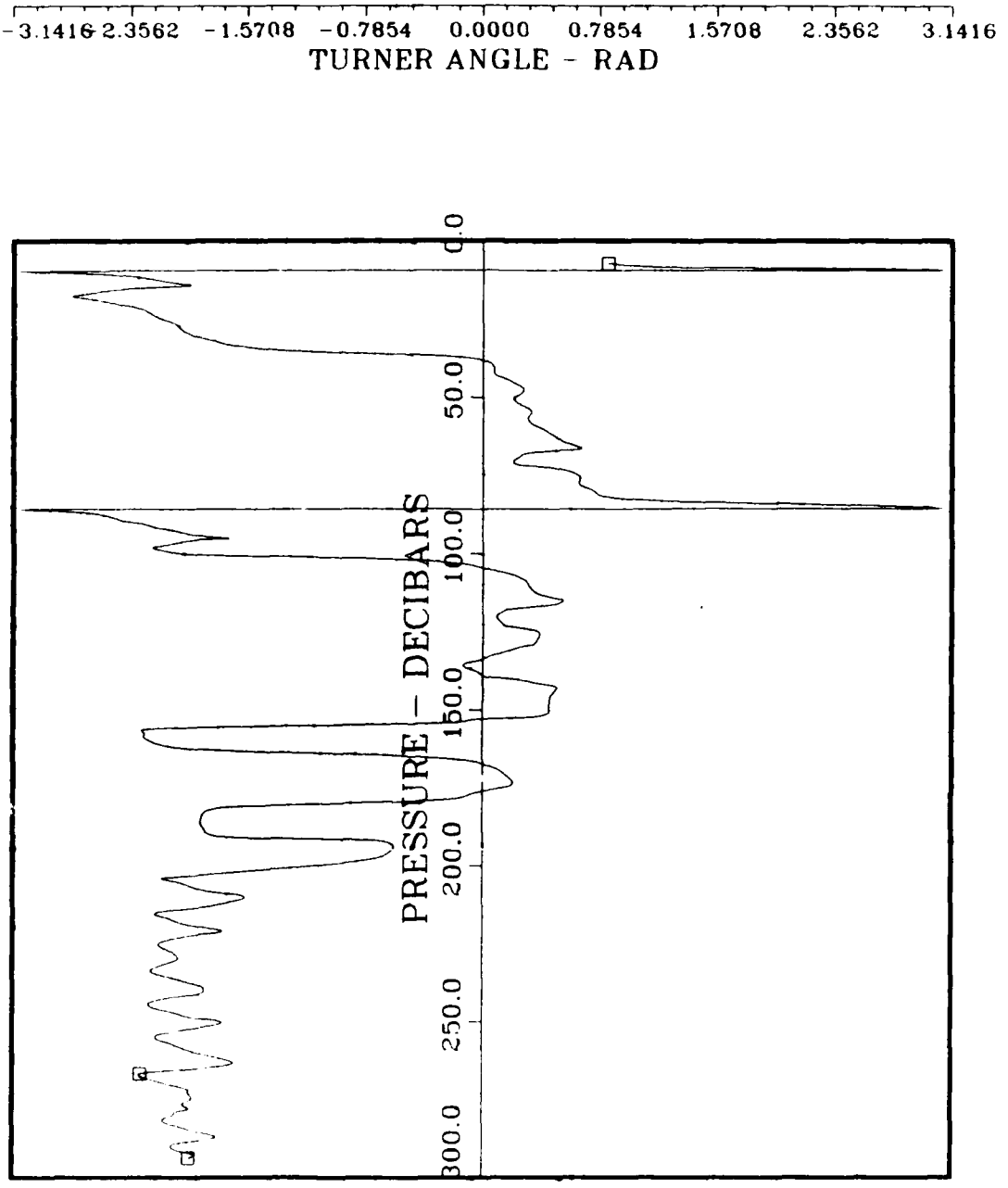

DYNAMICS OF CHEMICAL FRONTS - 1985

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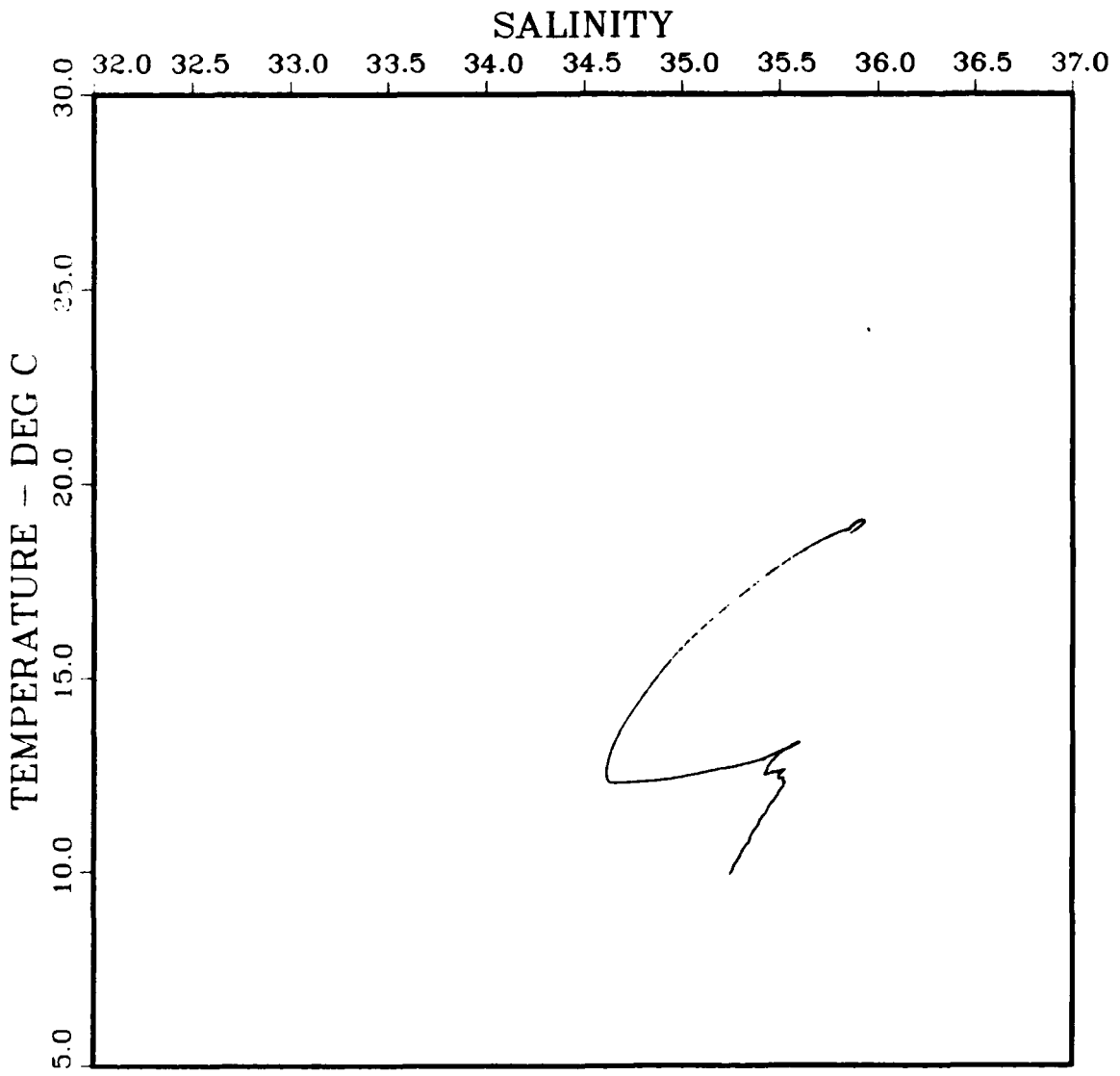

DYNAMICS OF CHEMICAL FRONTS

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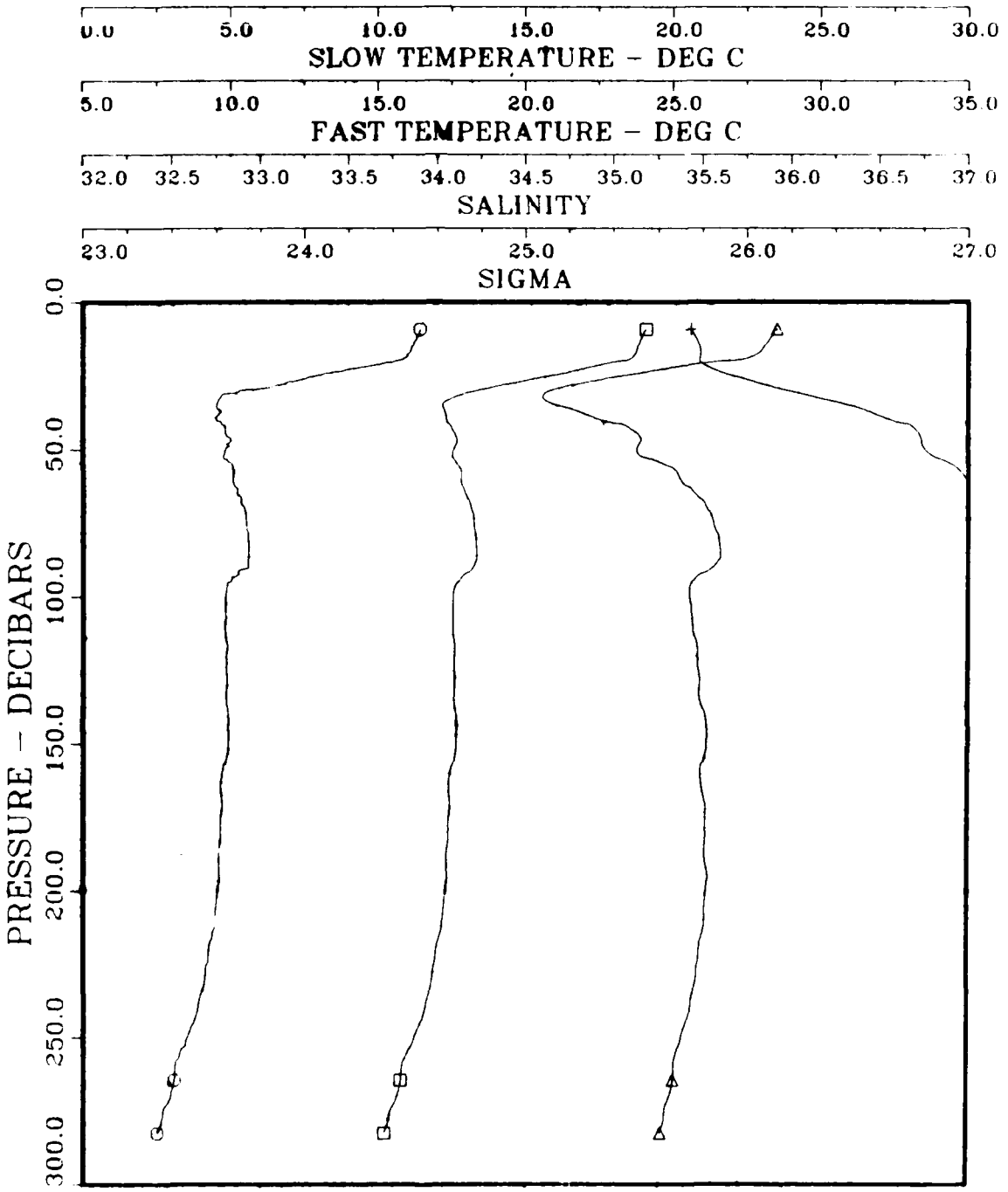

DYNAMICS OF CHEMICAL FRONTS - 1985

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GROUP NUMBER	8
JULIAN DATE	121.0160
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LEGEND

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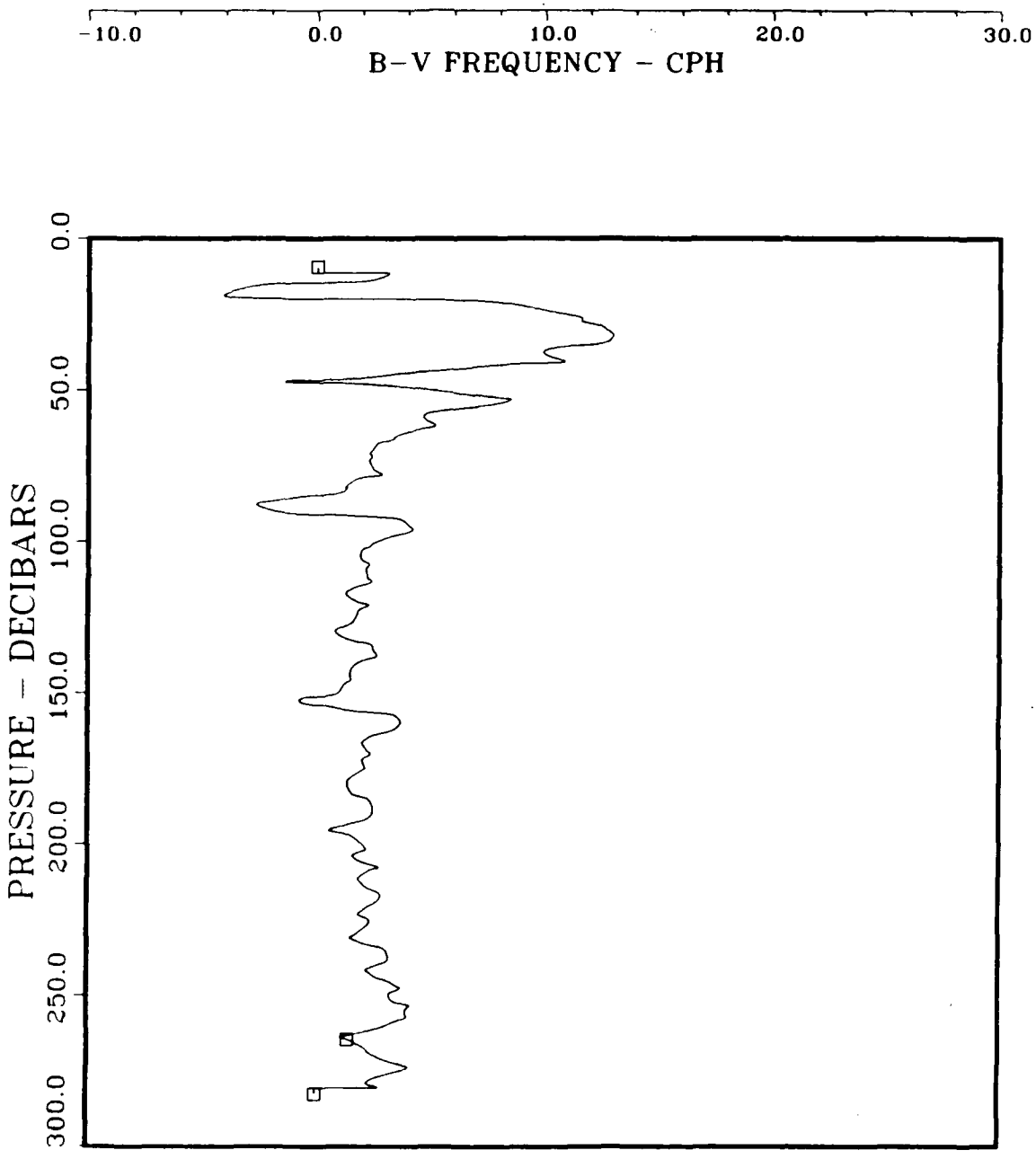

DYNAMICS OF CHEMICAL FRONTS - 1985

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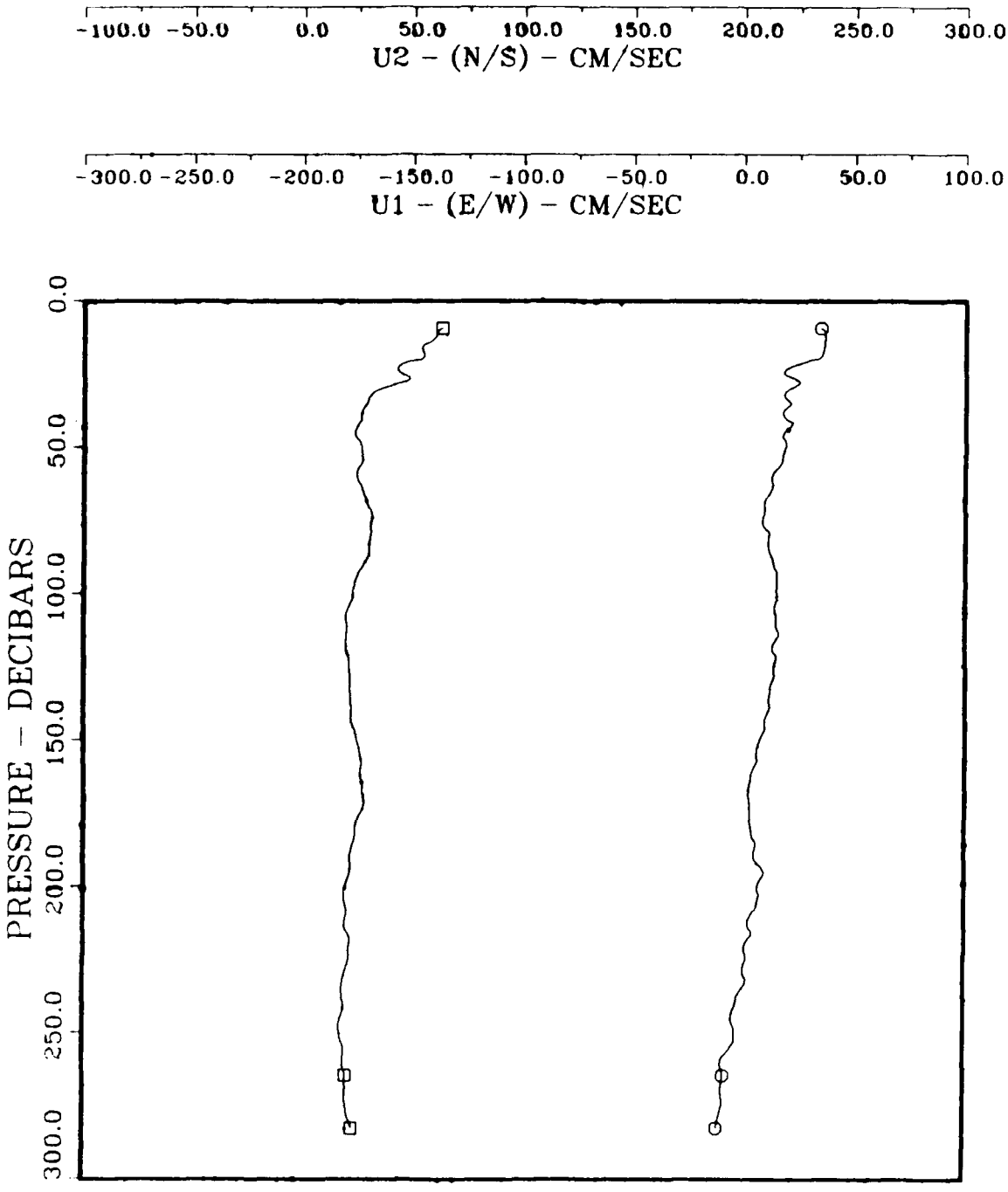
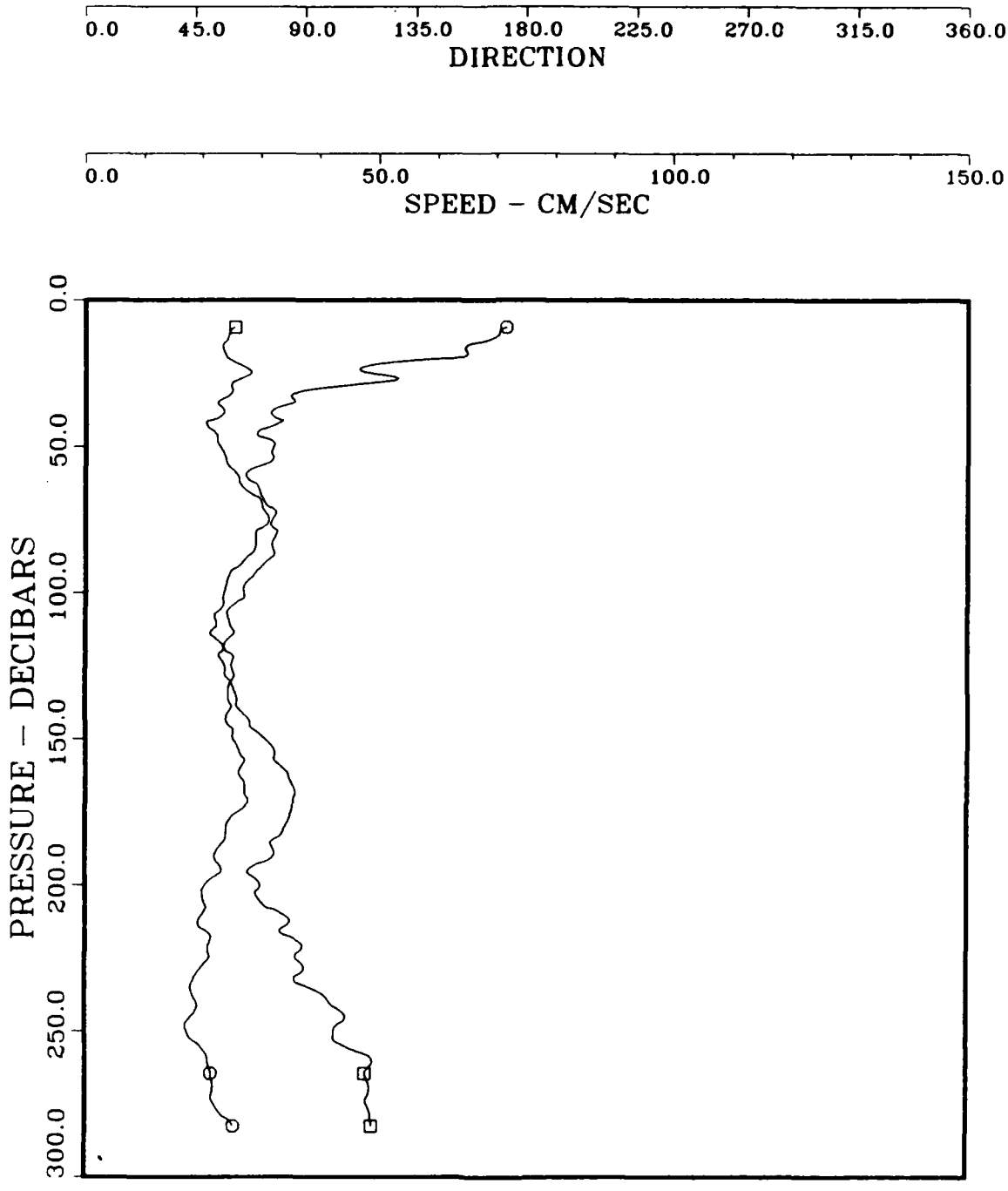
LATITUDE	37.845
LONGITUDE	-72.873



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	4
JULIAN DATE	121.0160
LATITUDE	37.845
LONGITUDE	-72.873

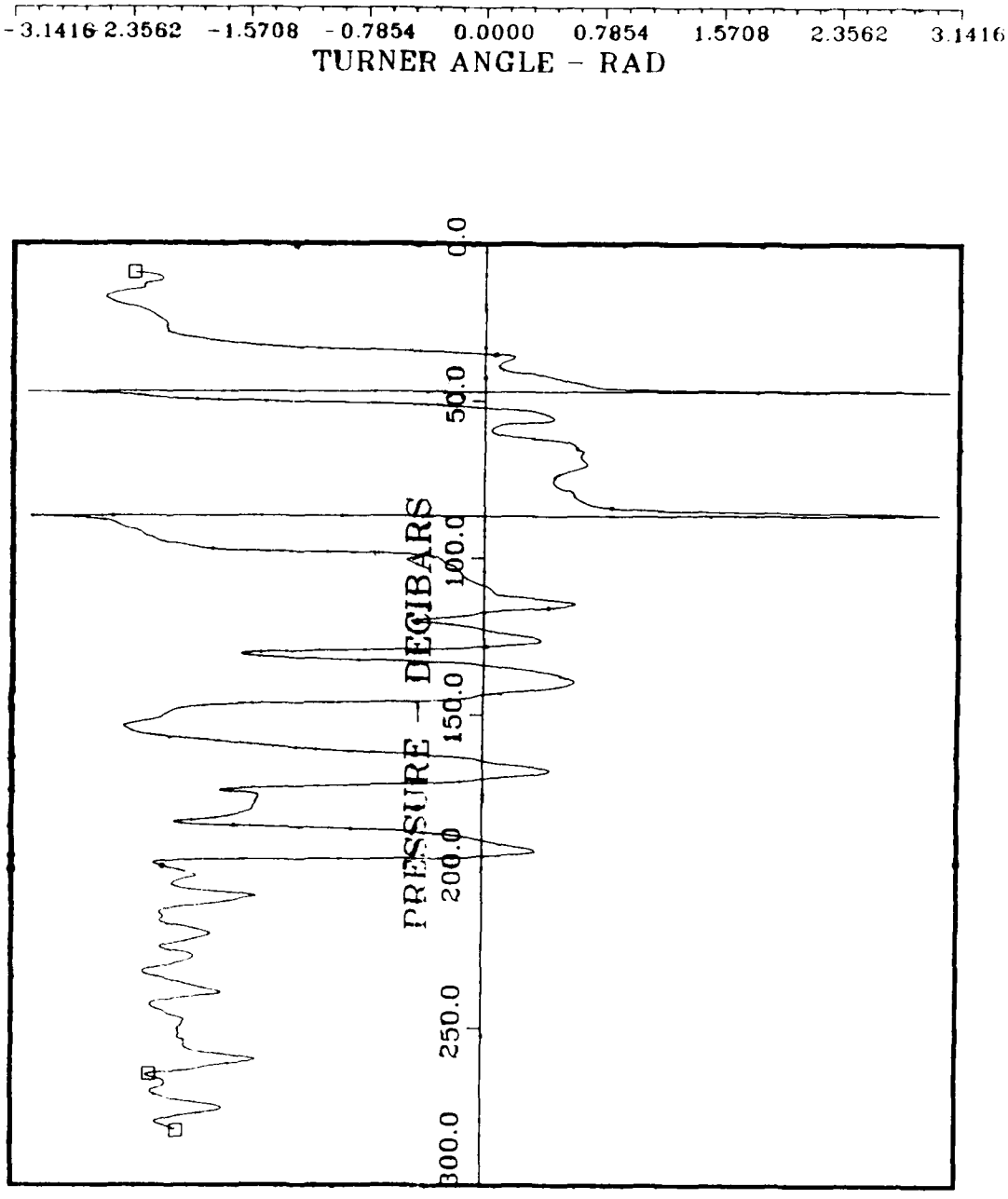
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

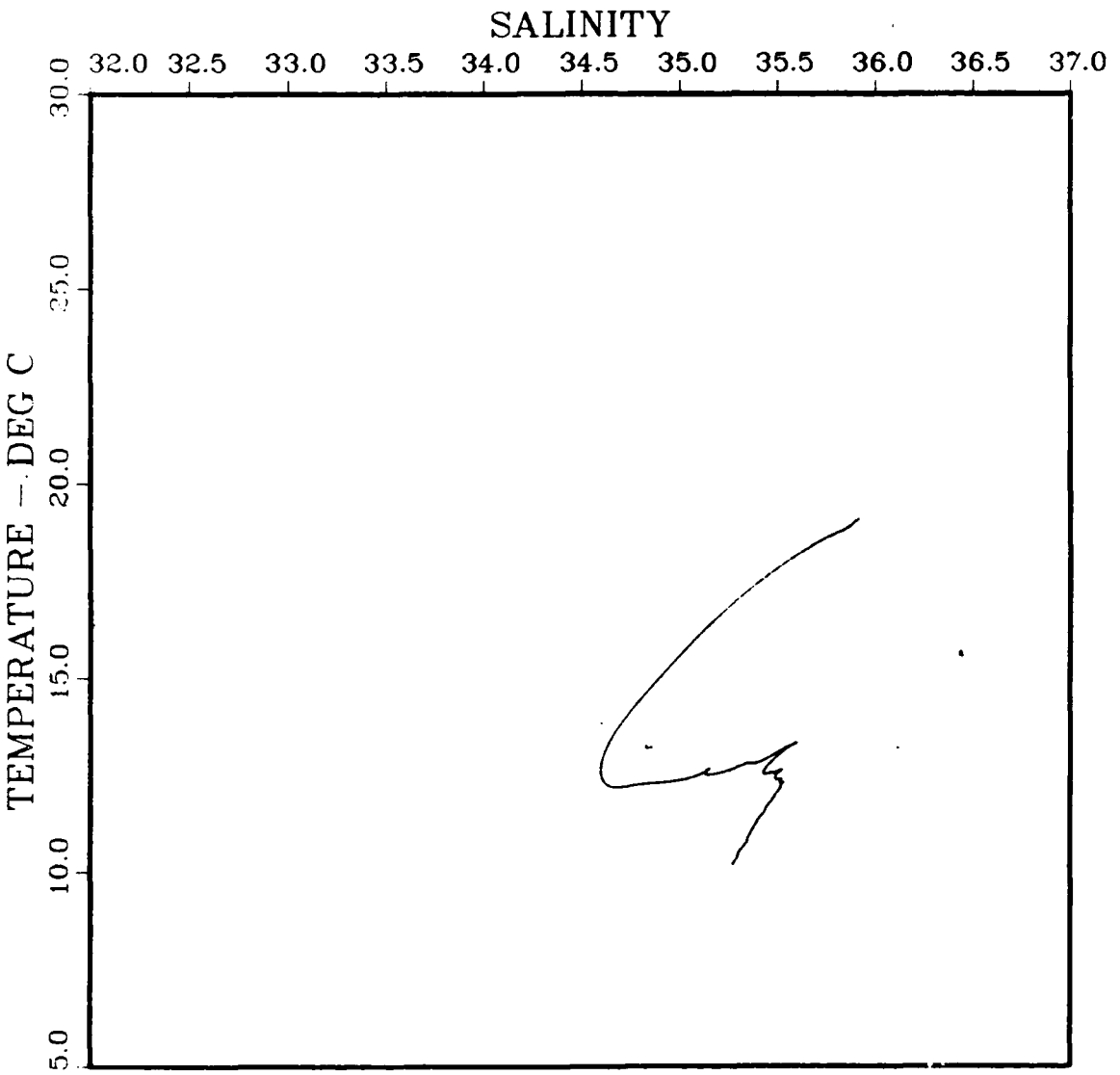
STATION	0
GROUP NUMBER	4
JULIAN DATE	121.0160
LATITUDE	37.845
LONGITUDE	-72.873

LEGEND
□ = DIRECTION
○ = SPEED



DYNAMICS OF CHEMICAL FRONTS - 1985

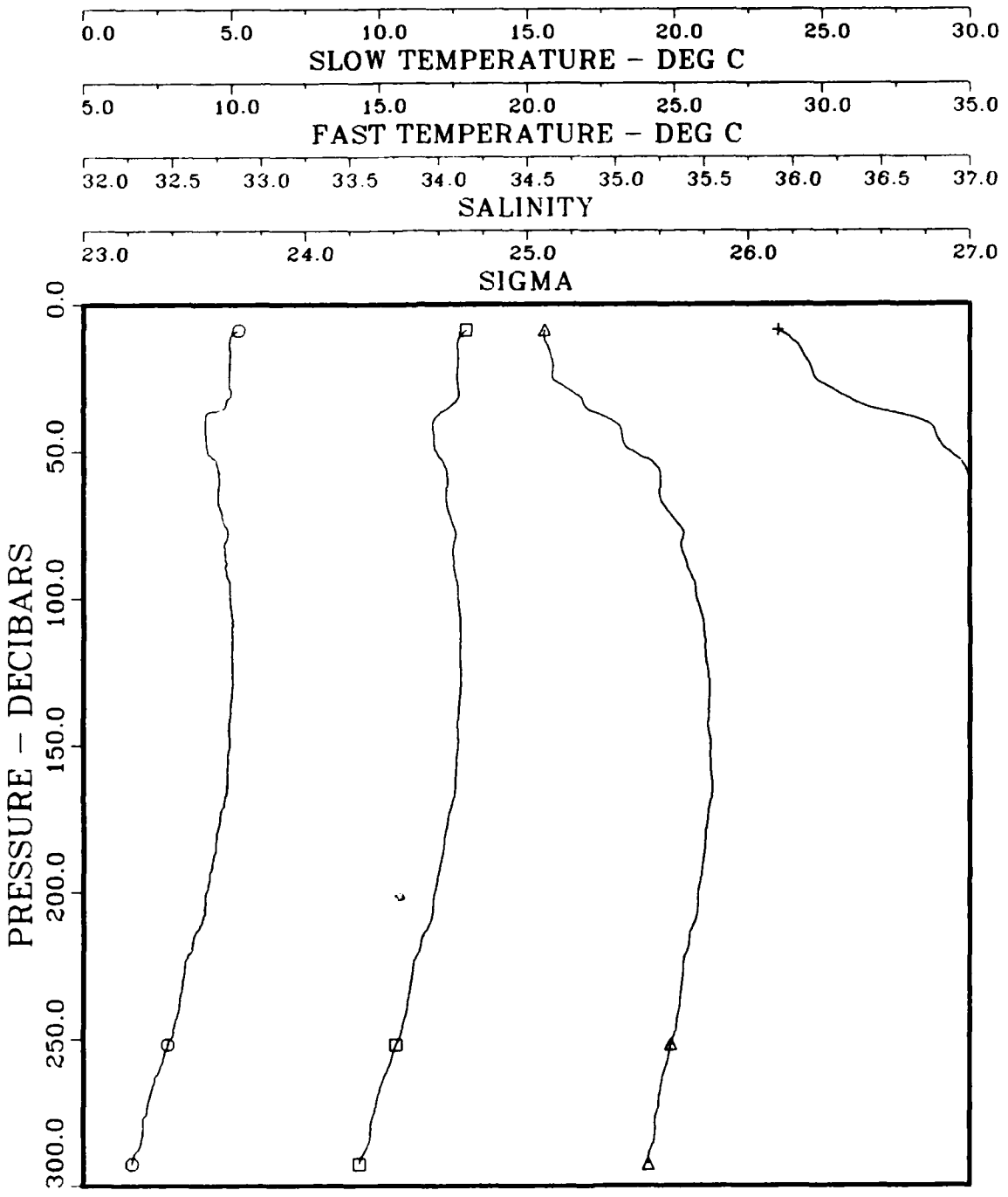
STATION	0
GROUP NUMBER	8
JULIAN DATE	121.0160
LATITUDE	37.845
LONGITUDE	-72.873



DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	8
JULIAN DATE	121.0160
LATITUDE	37.845
LONGITUDE	-72.873

STATION 3

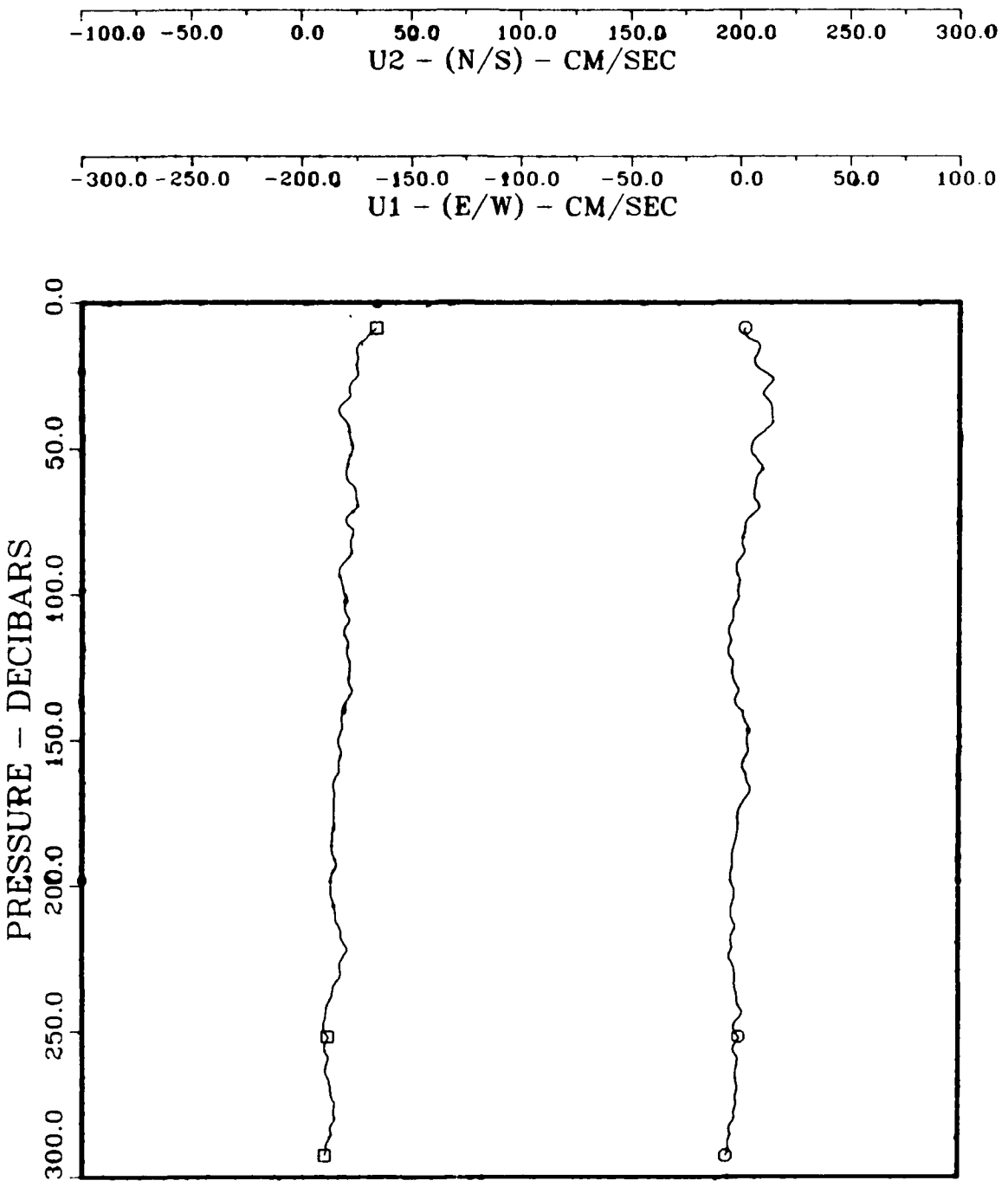


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	9
JULIAN DATE	121.2020
LATITUDE	37.880
LONGITUDE	–72.940

LEGEND

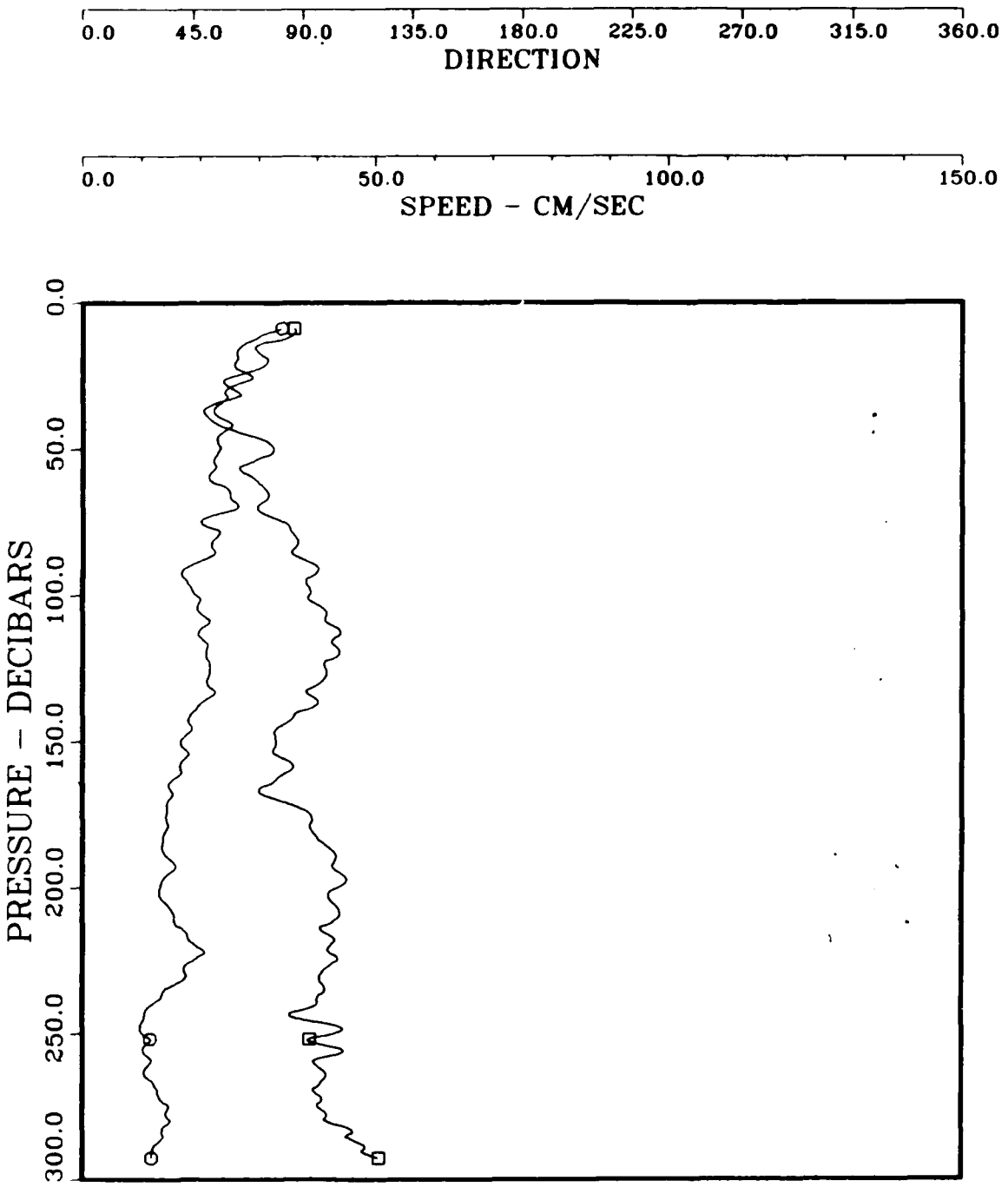
□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	5
JULIAN DATE	121.2020
LATITUDE	37.880
LONGITUDE	-72.940

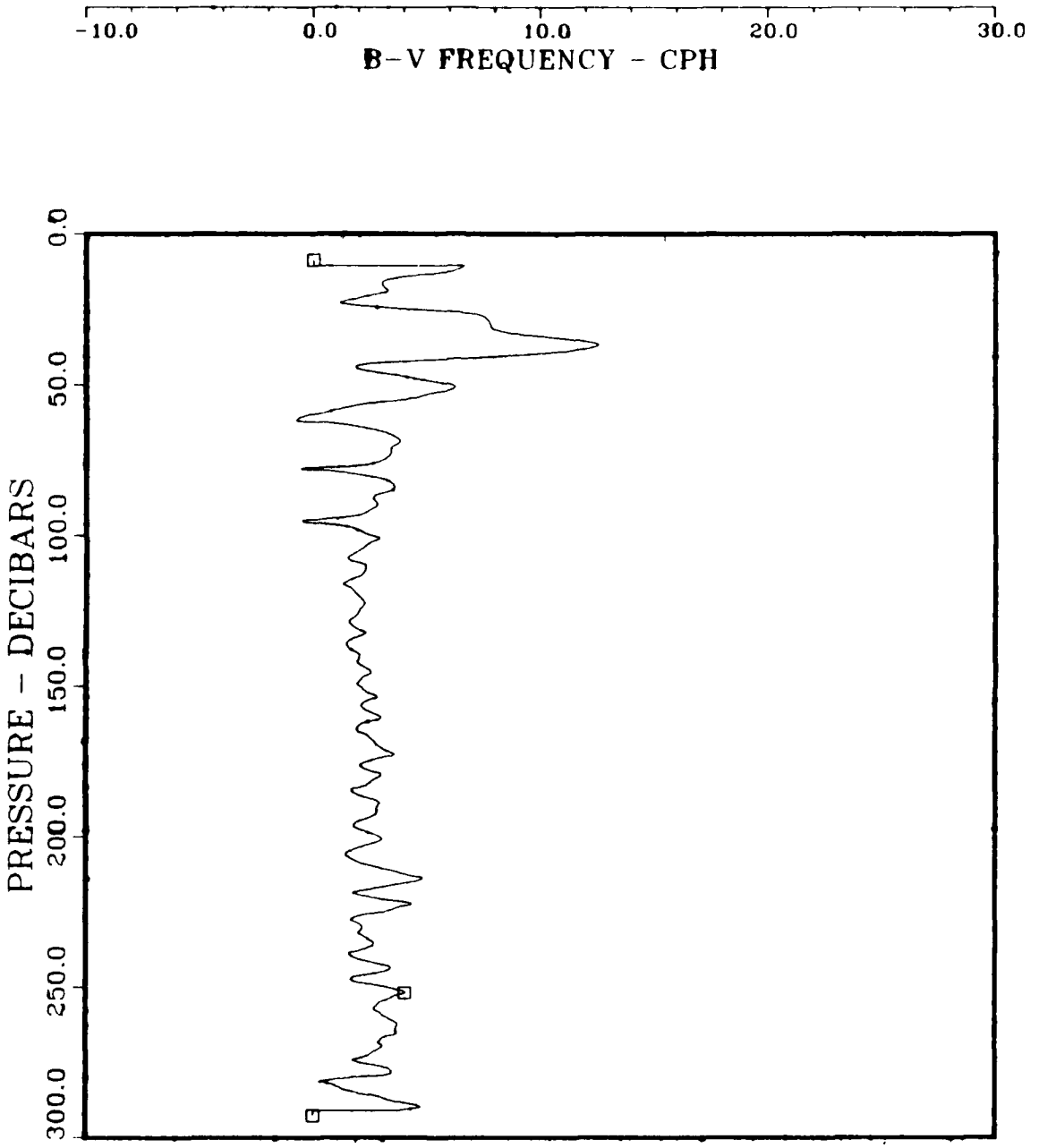
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

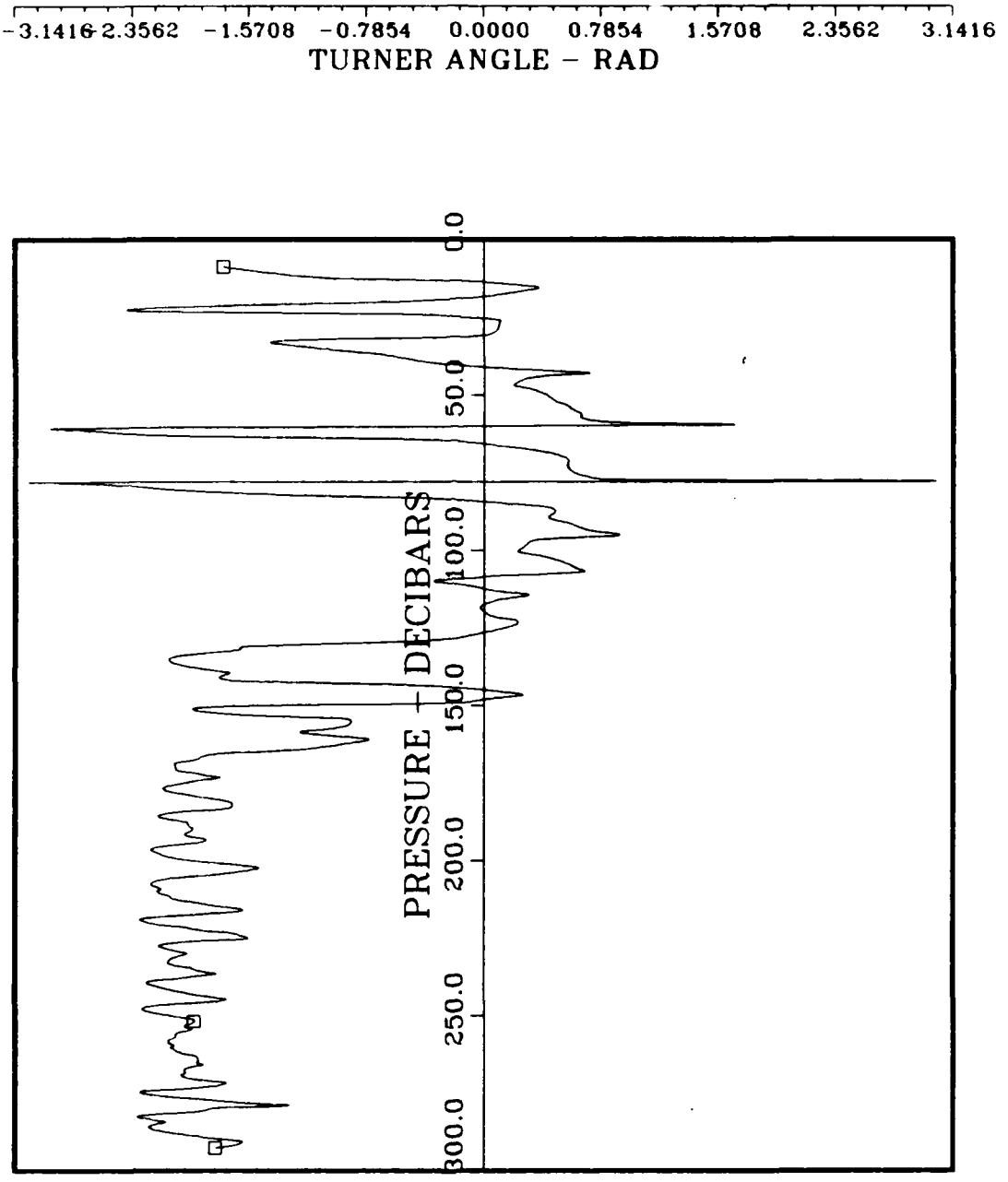
STATION	0
GROUP NUMBER	5
JULIAN DATE	121.2020
LATITUDE	37.880
LONGITUDE	-72.940

LEGEND
□ = DIRECTION
○ = SPEED



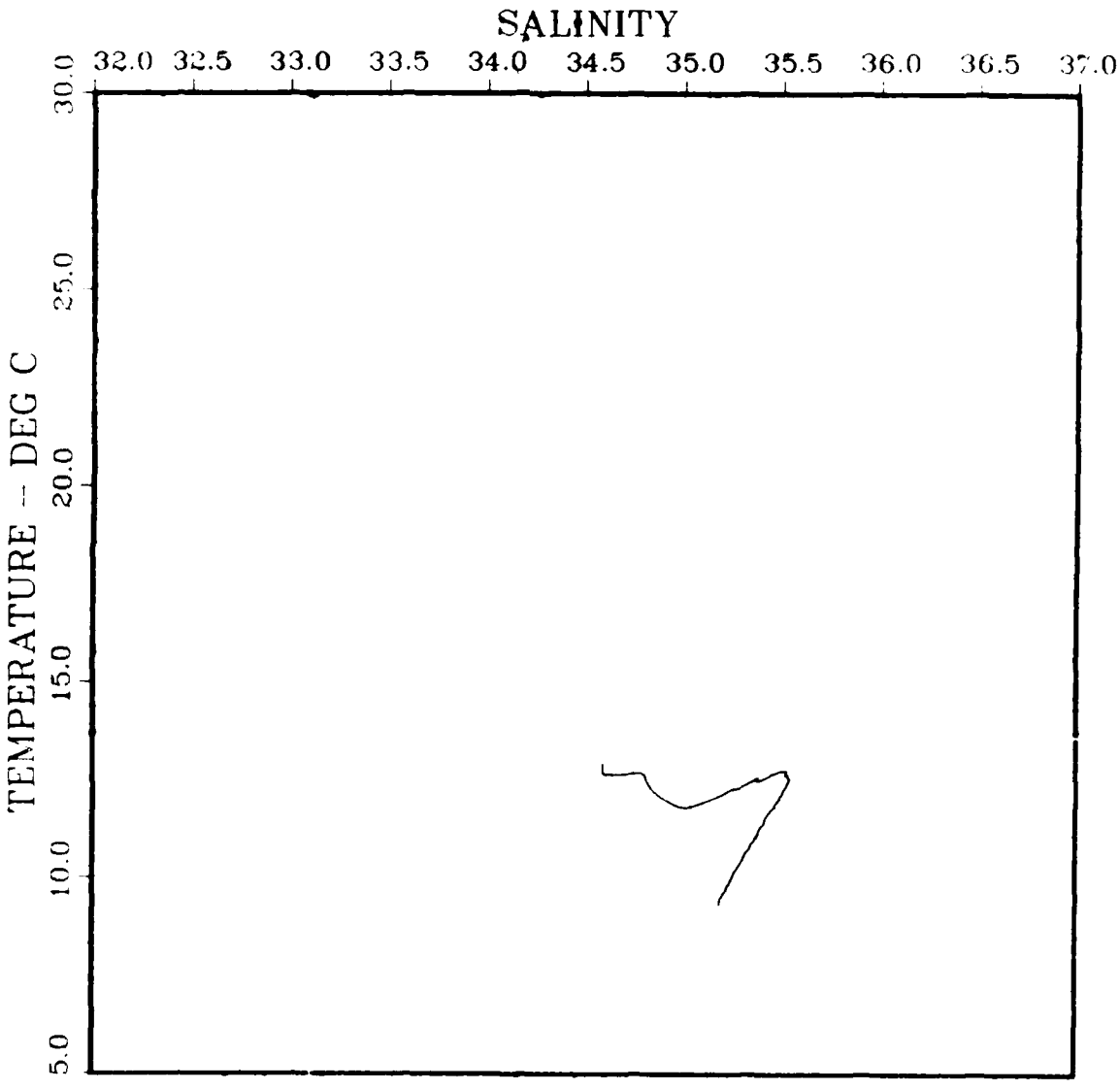
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	9
JULIAN DATE	121.2020
LATITUDE	37.880
LONGITUDE	-72.940



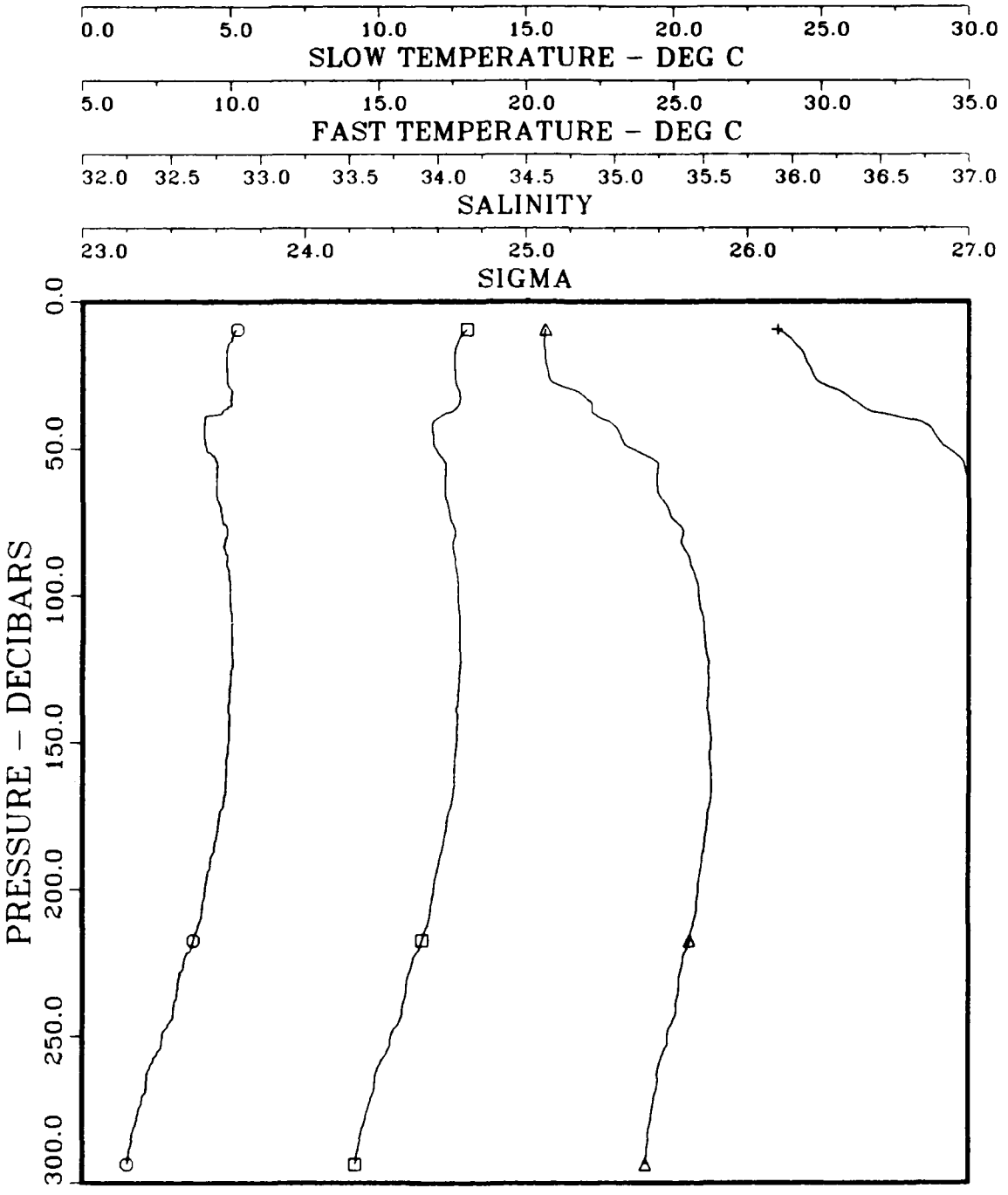
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	9
JULIAN DATE	121.2020
LATITUDE	37.880
LONGITUDE	-72.940



DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	9
JULIAN DATE	121.2020
LATITUDE	37.880
LONGITUDE	-72.940

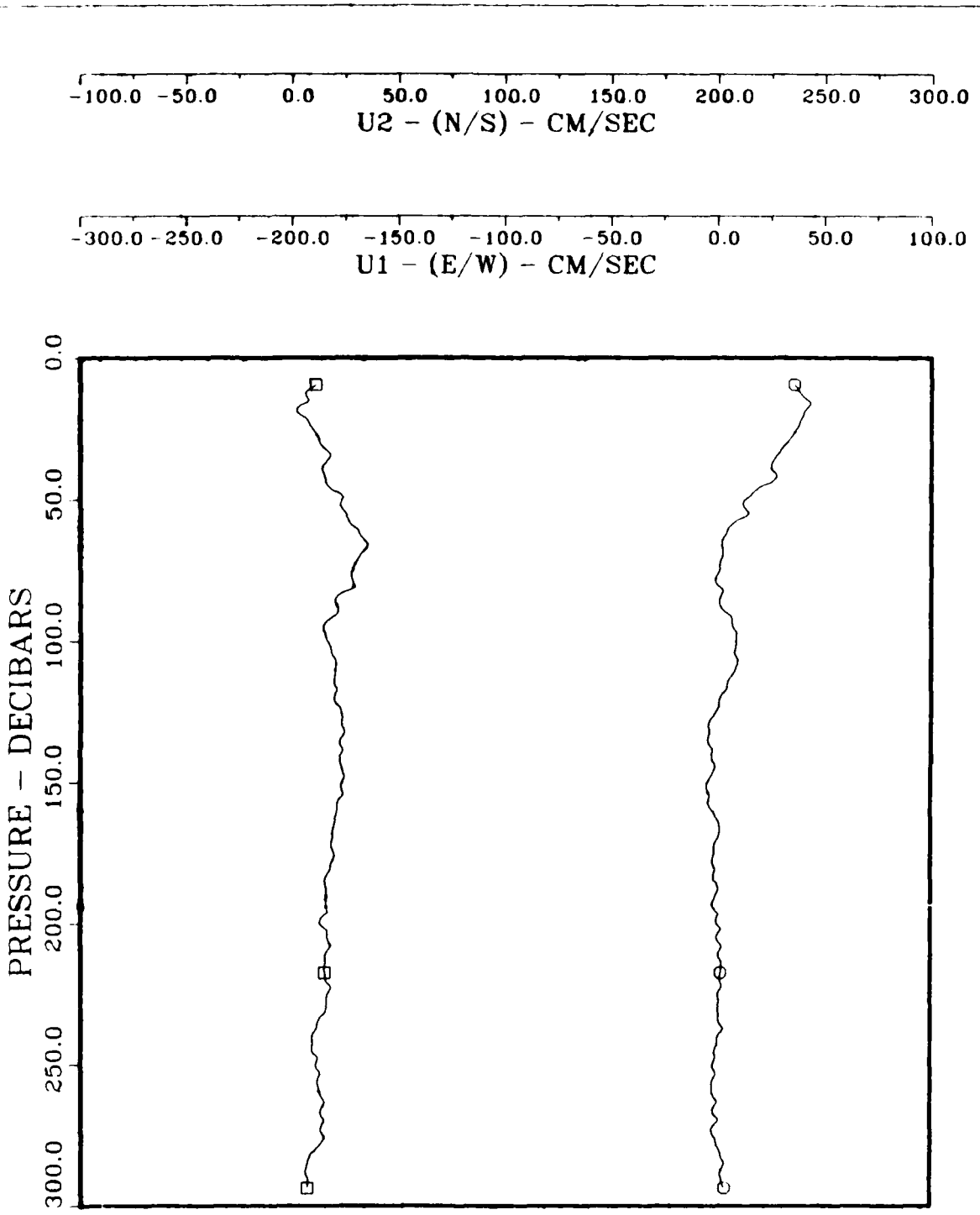


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	10
JULIAN DATE	121.2110
LATITUDE	37.880
LONGITUDE	–72.942

LEGEND

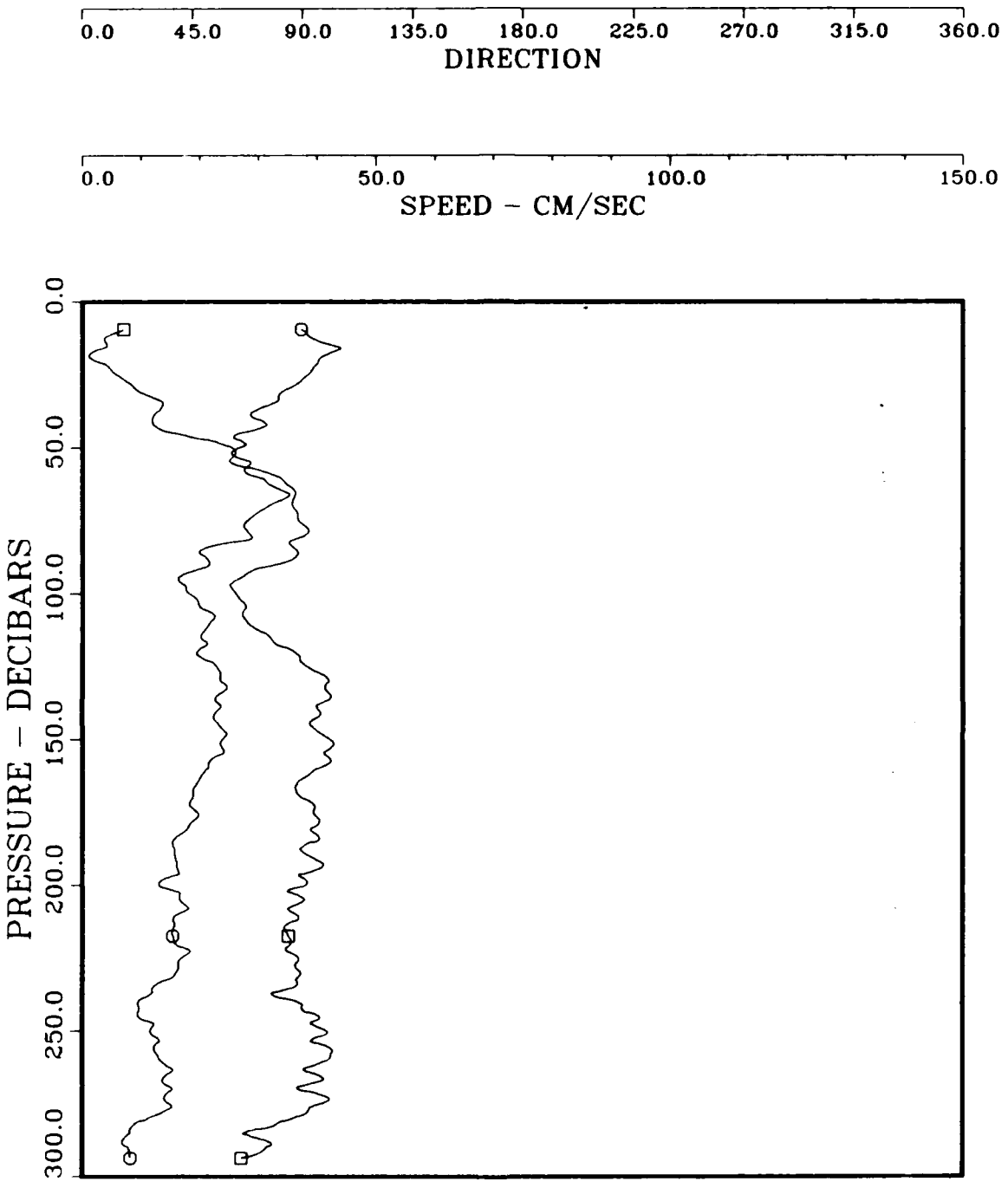
□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	6
JULIAN DATE	121.2110
LATITUDE	37.880
LONGITUDE	-72.942

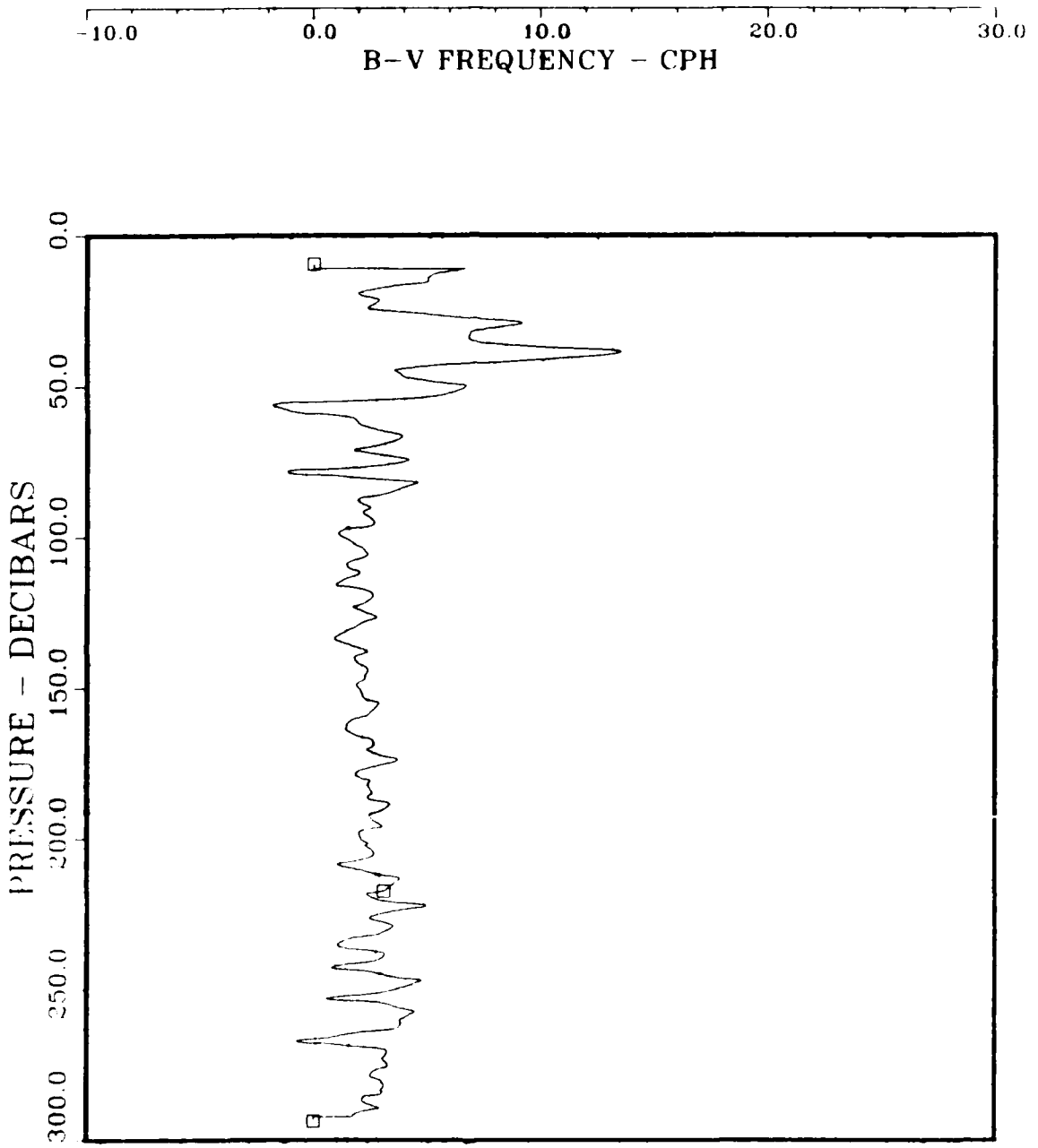
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

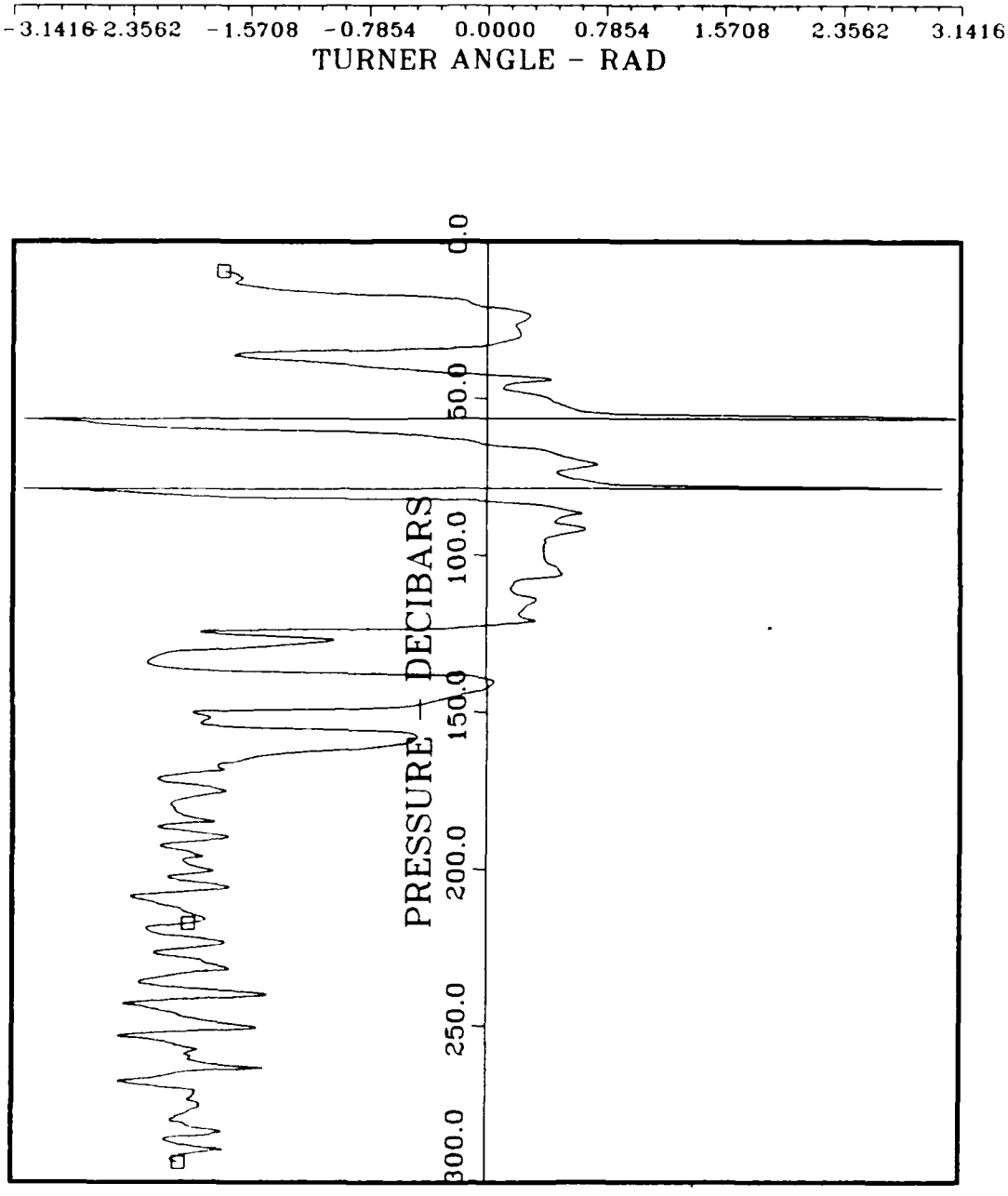
STATION	0
GROUP NUMBER	6
JULIAN DATE	121.2110
LATITUDE	37.880
LONGITUDE	-72.942

LEGEND
□ = DIRECTION
○ = SPEED



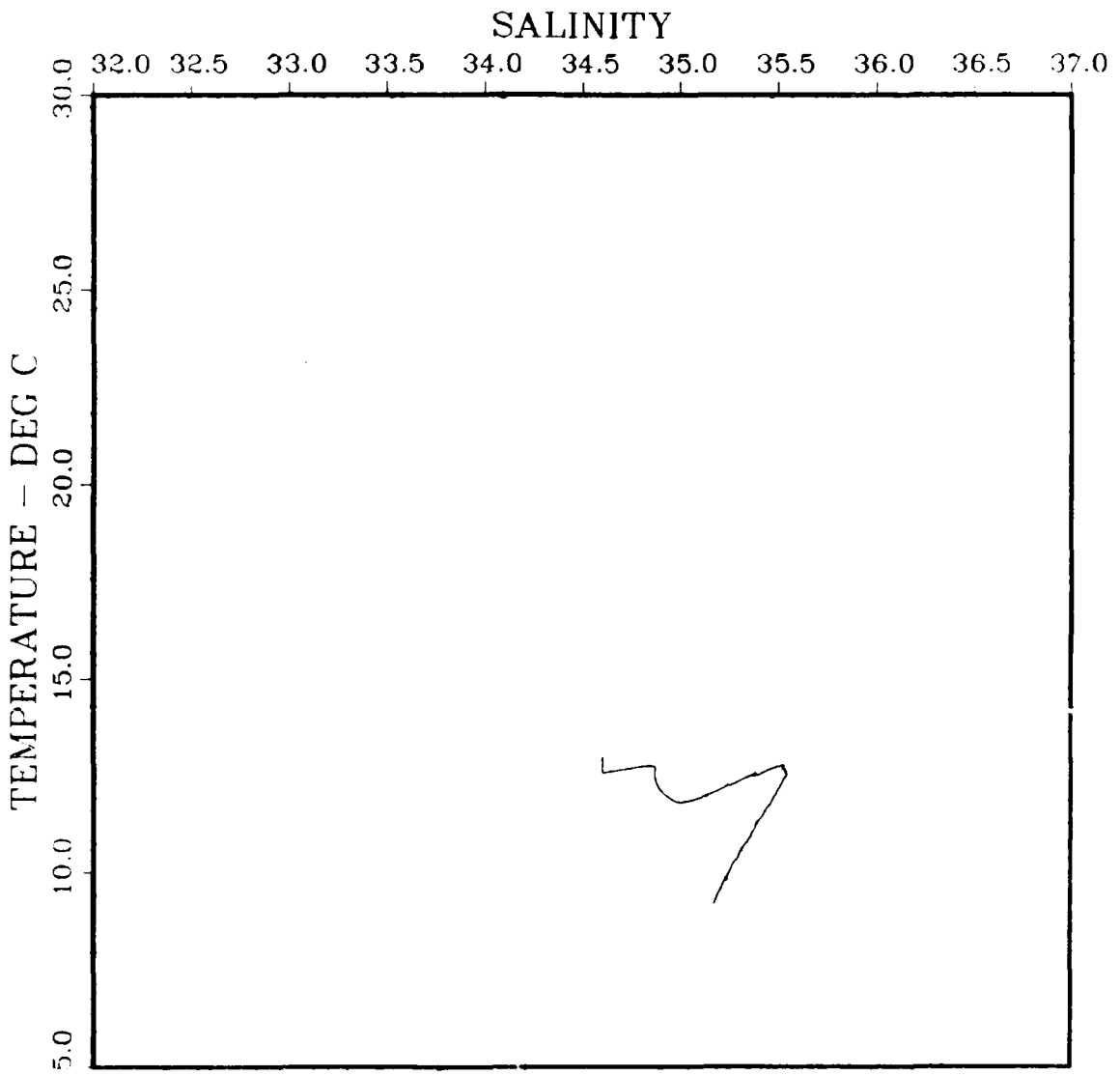
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	10
JULIAN DATE	121.2110
LATITUDE	37.880
LONGITUDE	-72.942



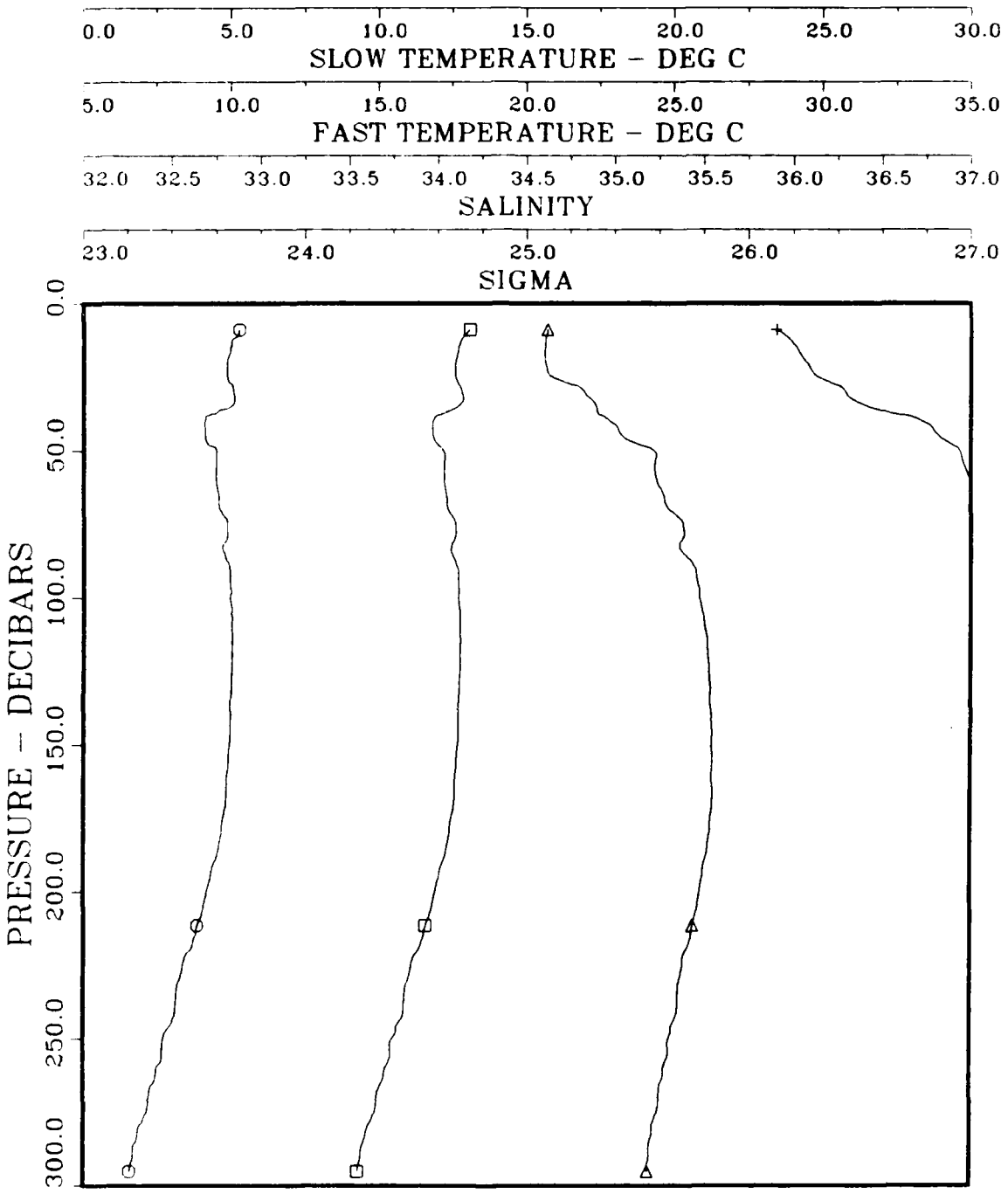
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	10
JULIAN DATE	121.2110
LATITUDE	37.880
LONGITUDE	-72.942



DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	10
JULIAN DATE	121.2110
LATITUDE	37.380
LONGITUDE	-72.942

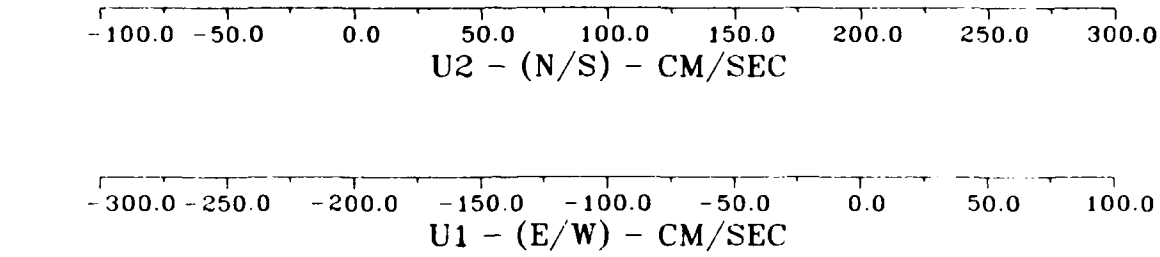


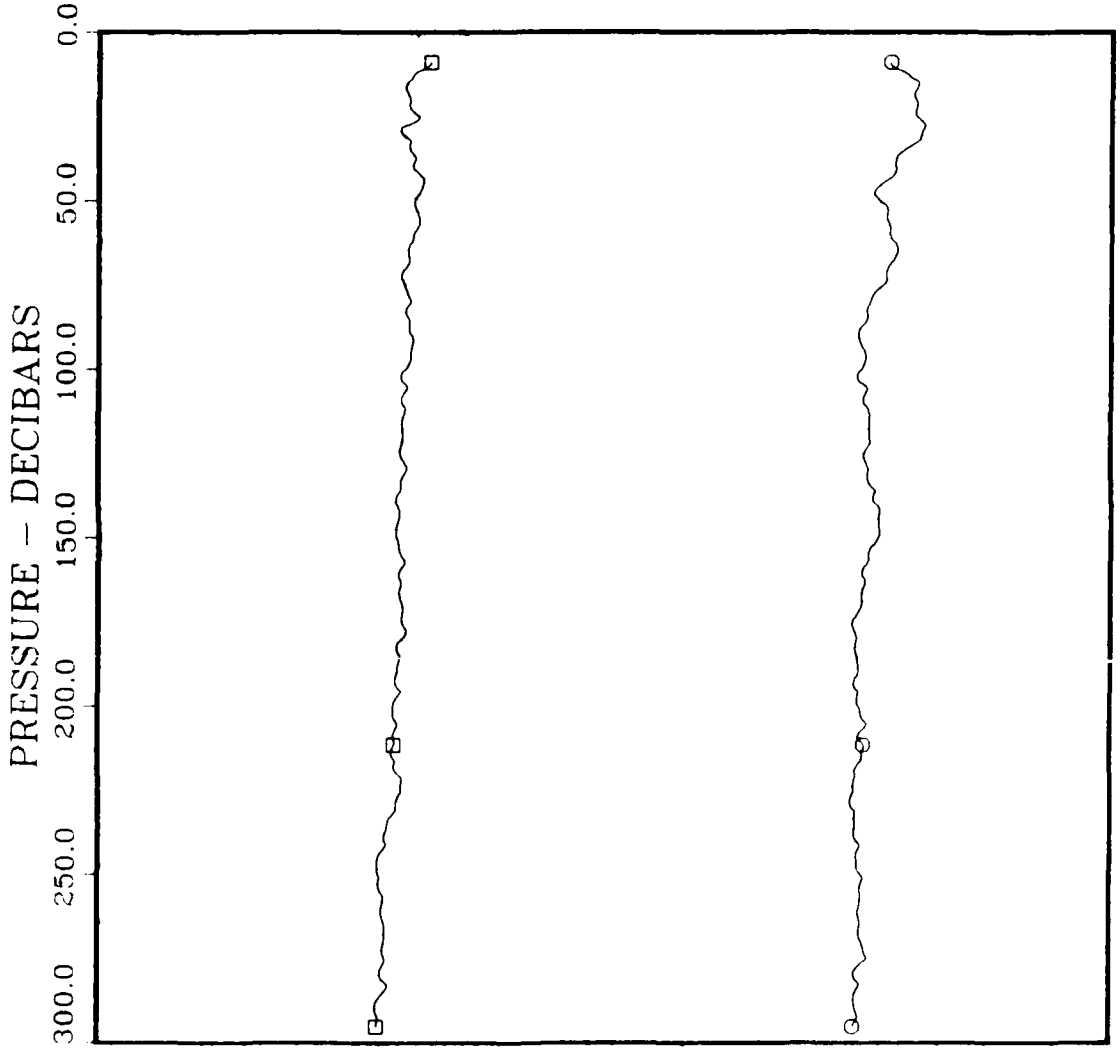
DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	11
JULIAN DATE	121.2210
LATITUDE	37.878
LONGITUDE	–72.942

LEGEND

□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
+ = SIGMA

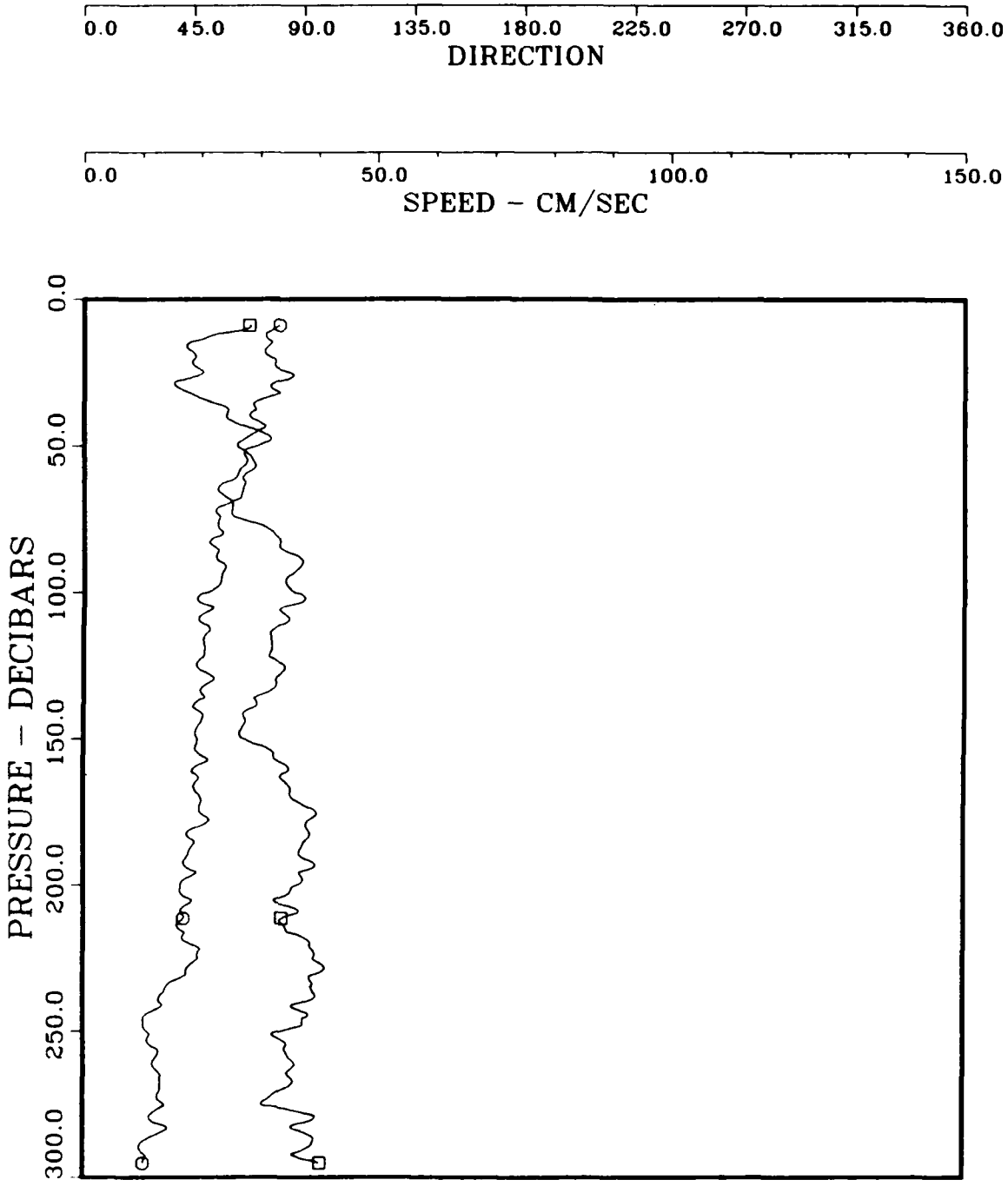




DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	7
JULIAN DATE	121.2210
LATITUDE	37.878
LONGITUDE	-72.942

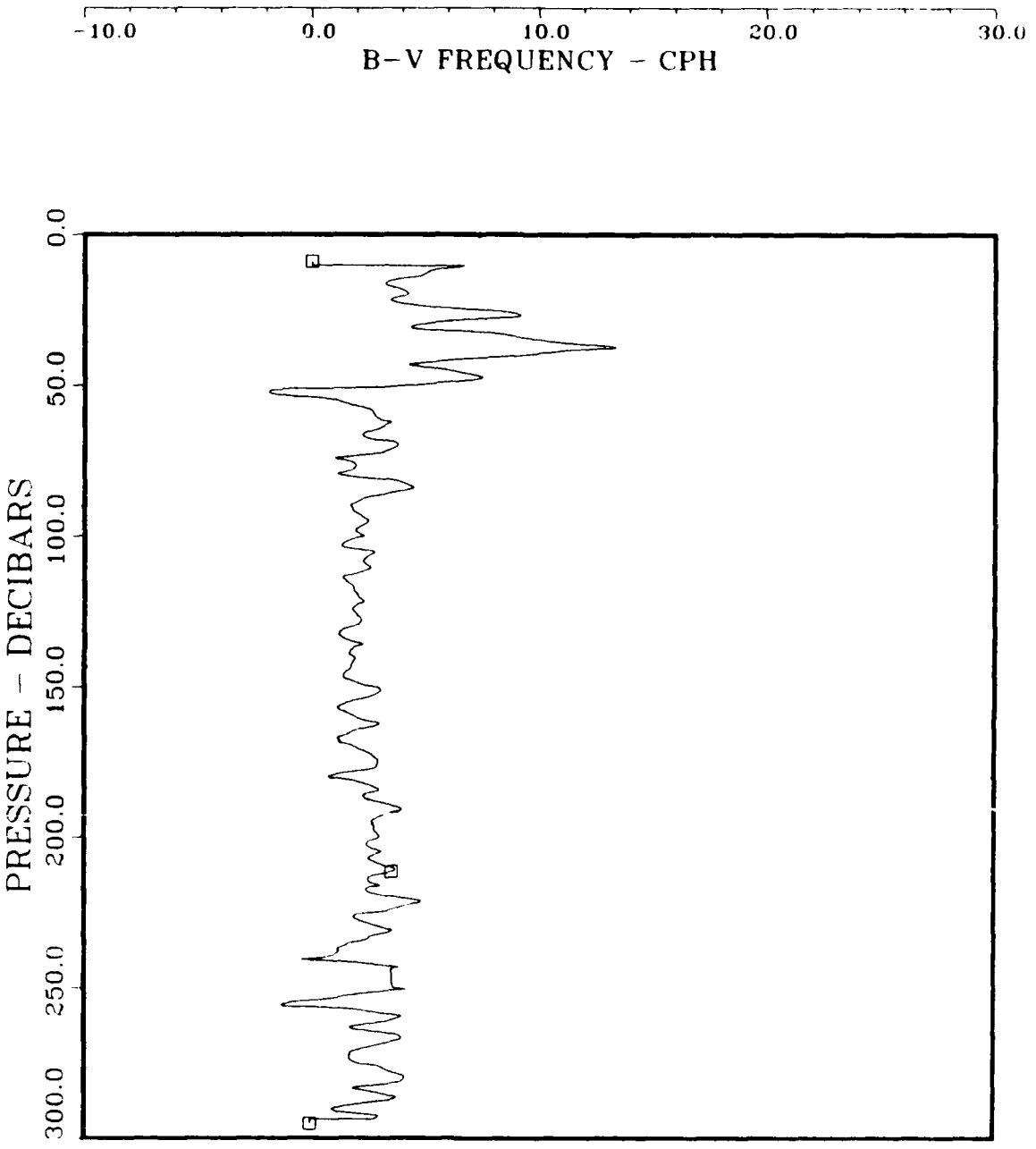
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

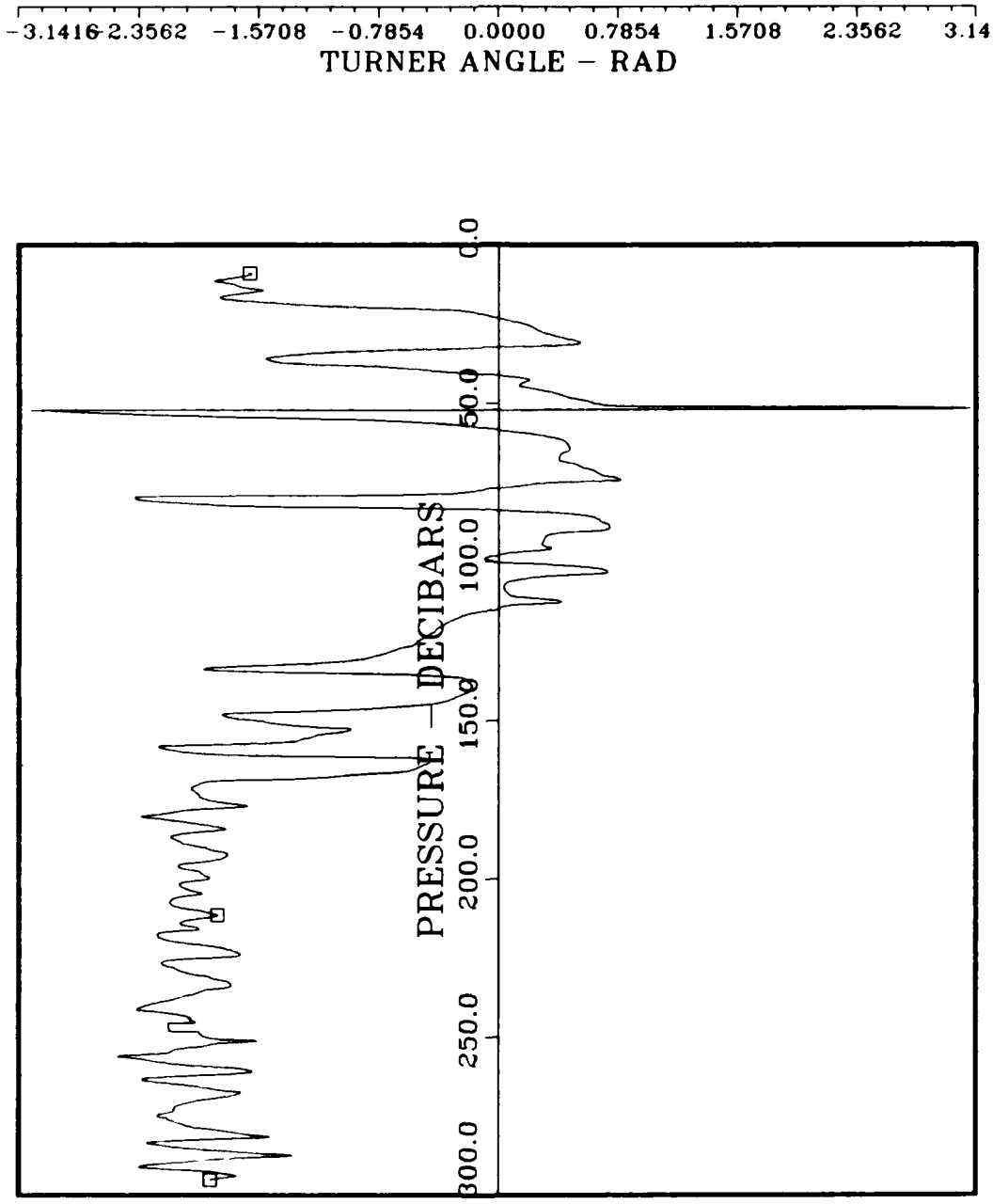
STATION	0
GROUP NUMBER	7
JULIAN DATE	121.2210
LATITUDE	37.878
LONGITUDE	-72.942

LEGEND
□ = DIRECTION
○ = SPEED



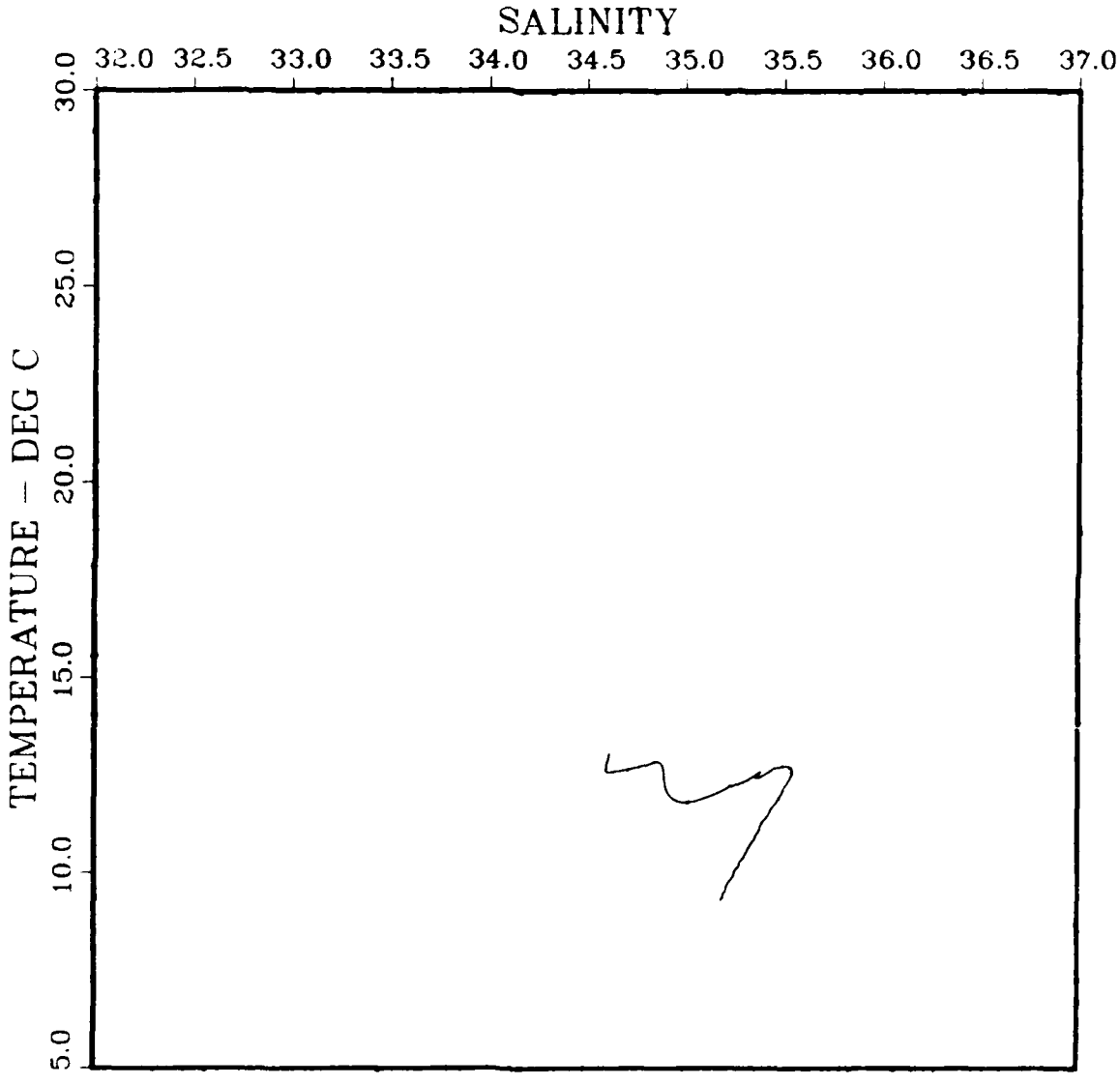
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	11
JULIAN DATE	121.2210
LATITUDE	37.878
LONGITUDE	-72.942



DYNAMICS OF CHEMICAL FRONTS - 1985

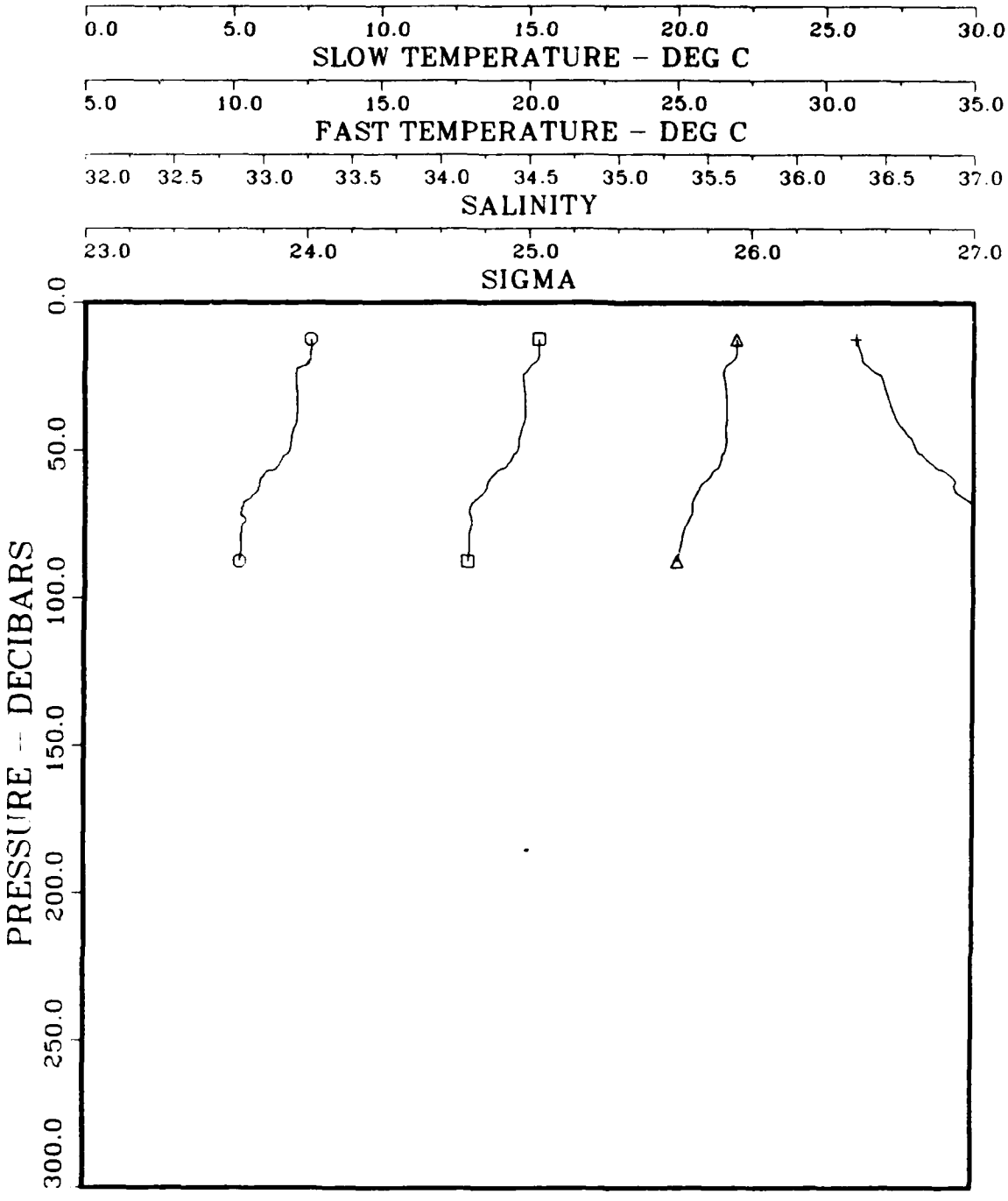
STATION	0
GROUP NUMBER	11
JULIAN DATE	121.2210
LATITUDE	37.878
LONGITUDE	-72.942



DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	11
JULIAN DATE	121.2210
LATITUDE	37.878
LONGITUDE	-72.942

STATION 4

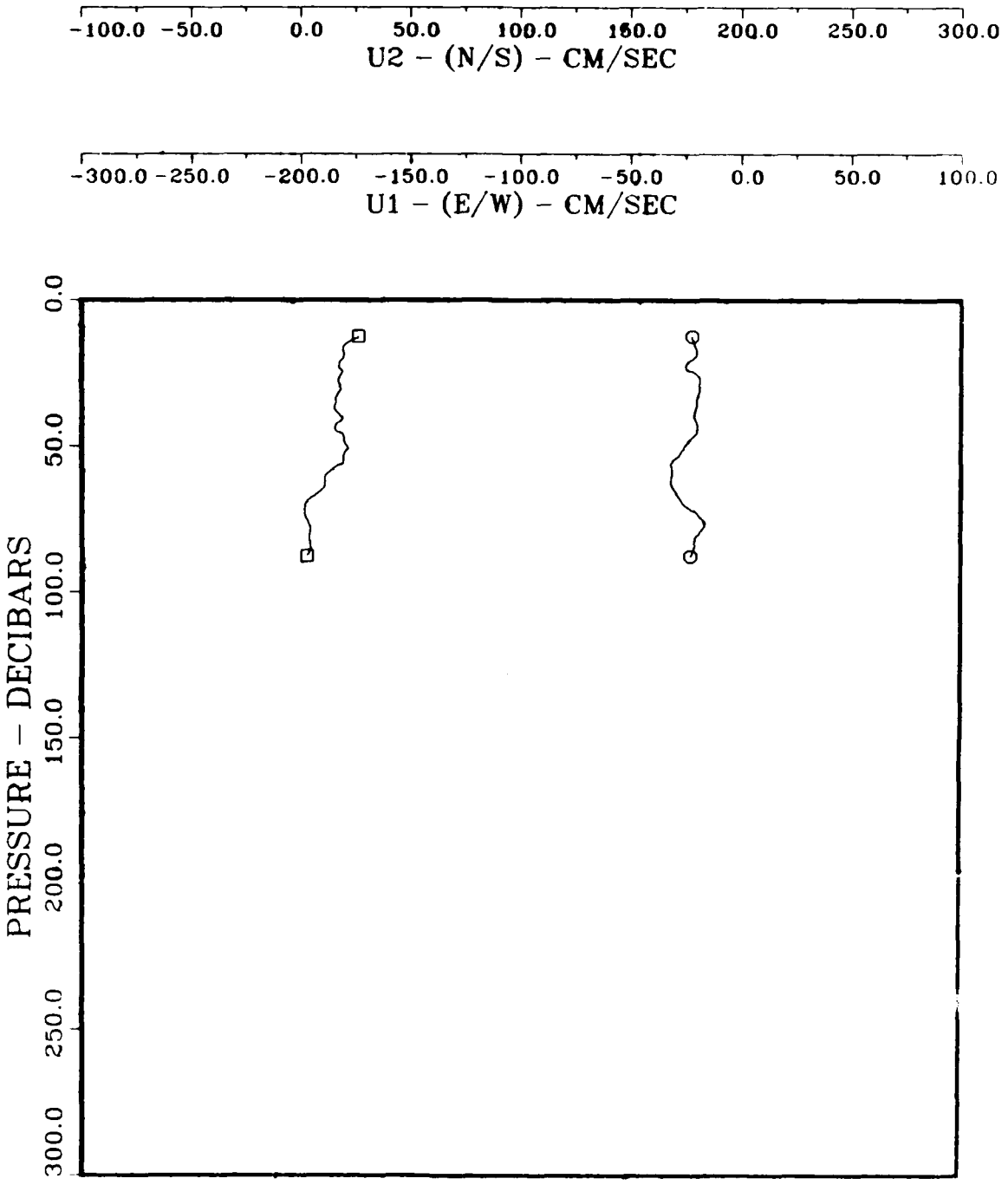


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	12
JULIAN DATE	121.4140
LATITUDE	38.283
LONGITUDE	-73.150

LEGEND

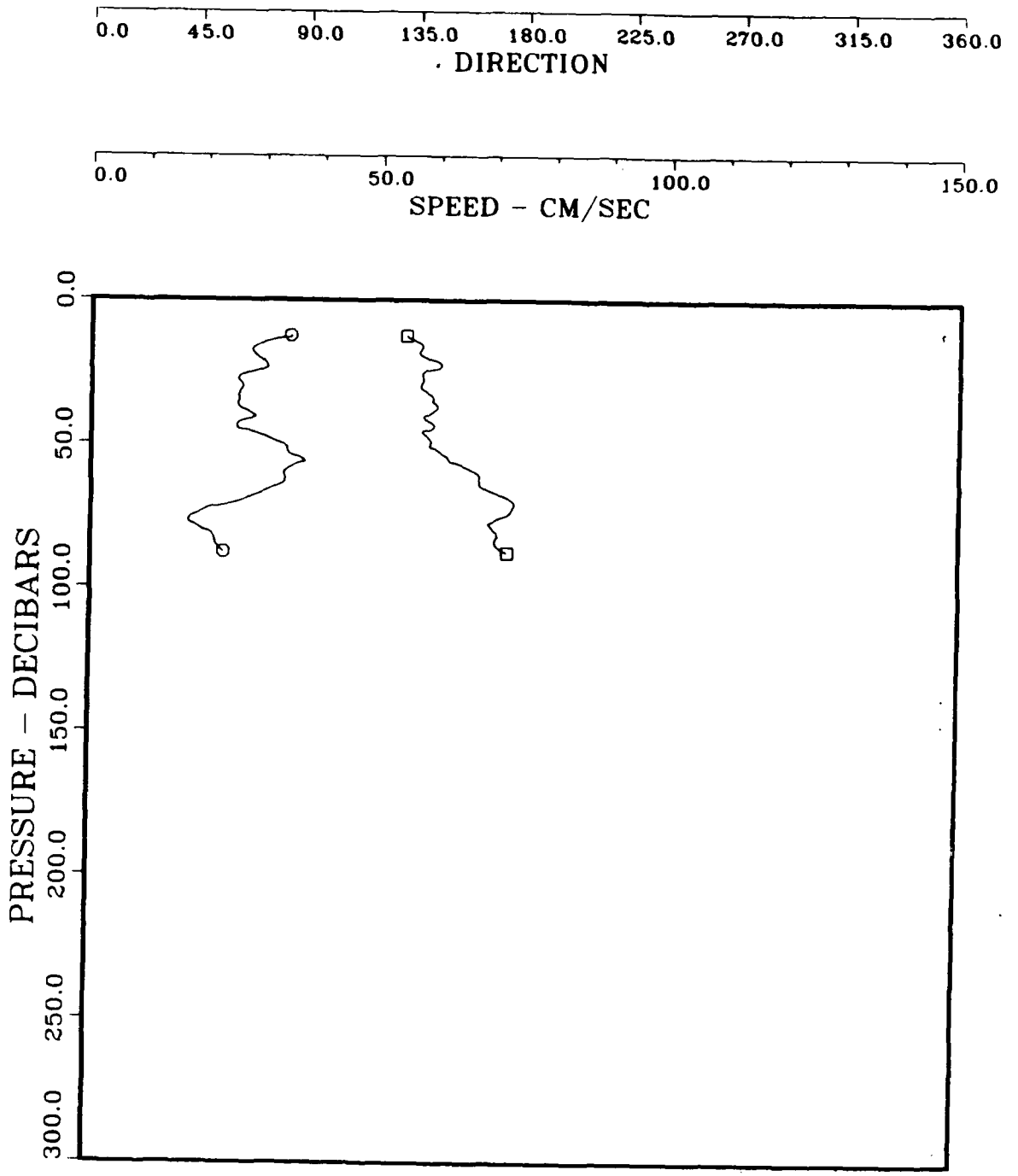
□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	8
JULIAN DATE	121.4140
LATITUDE	38.283
LONGITUDE	-73.150

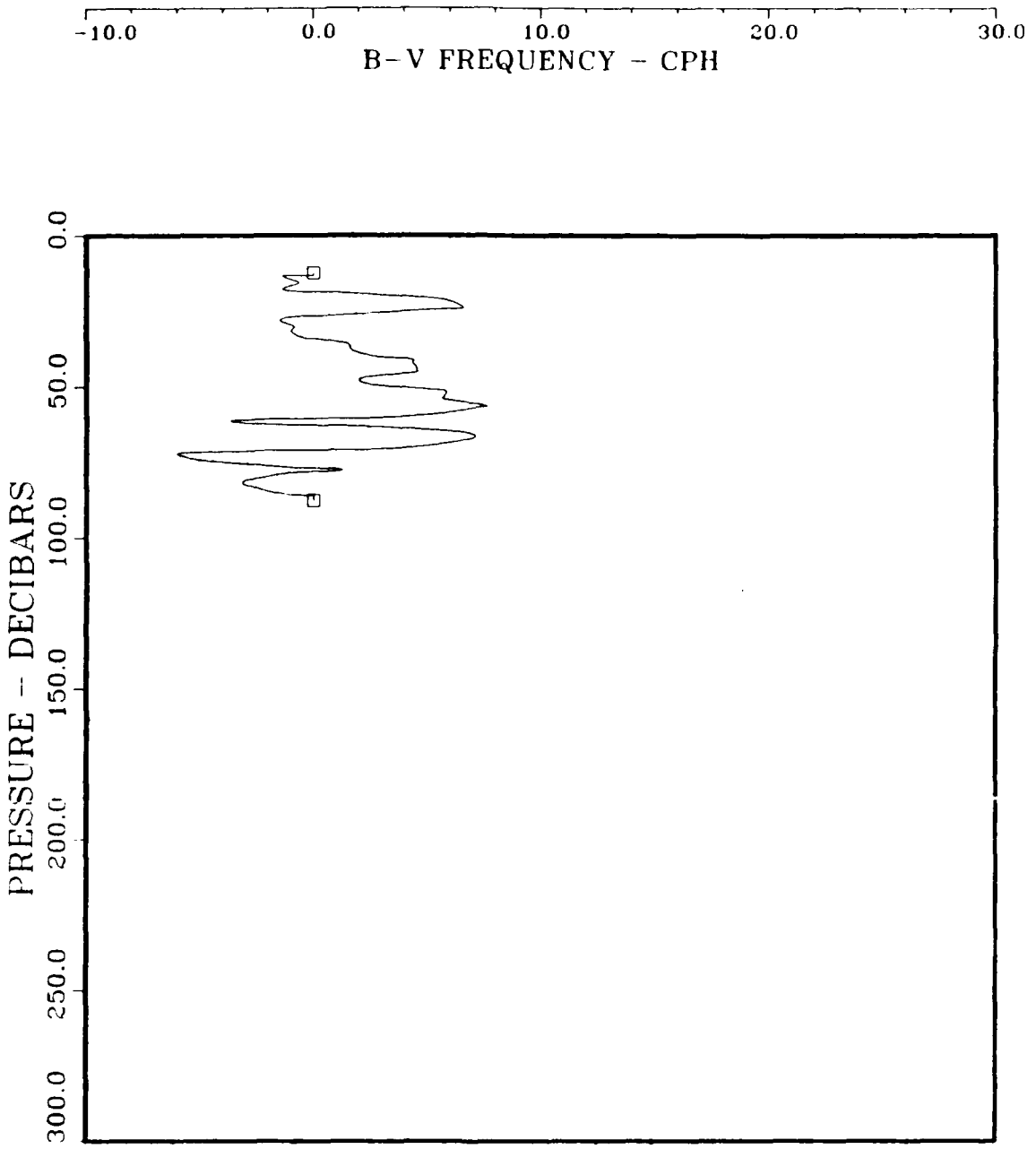
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

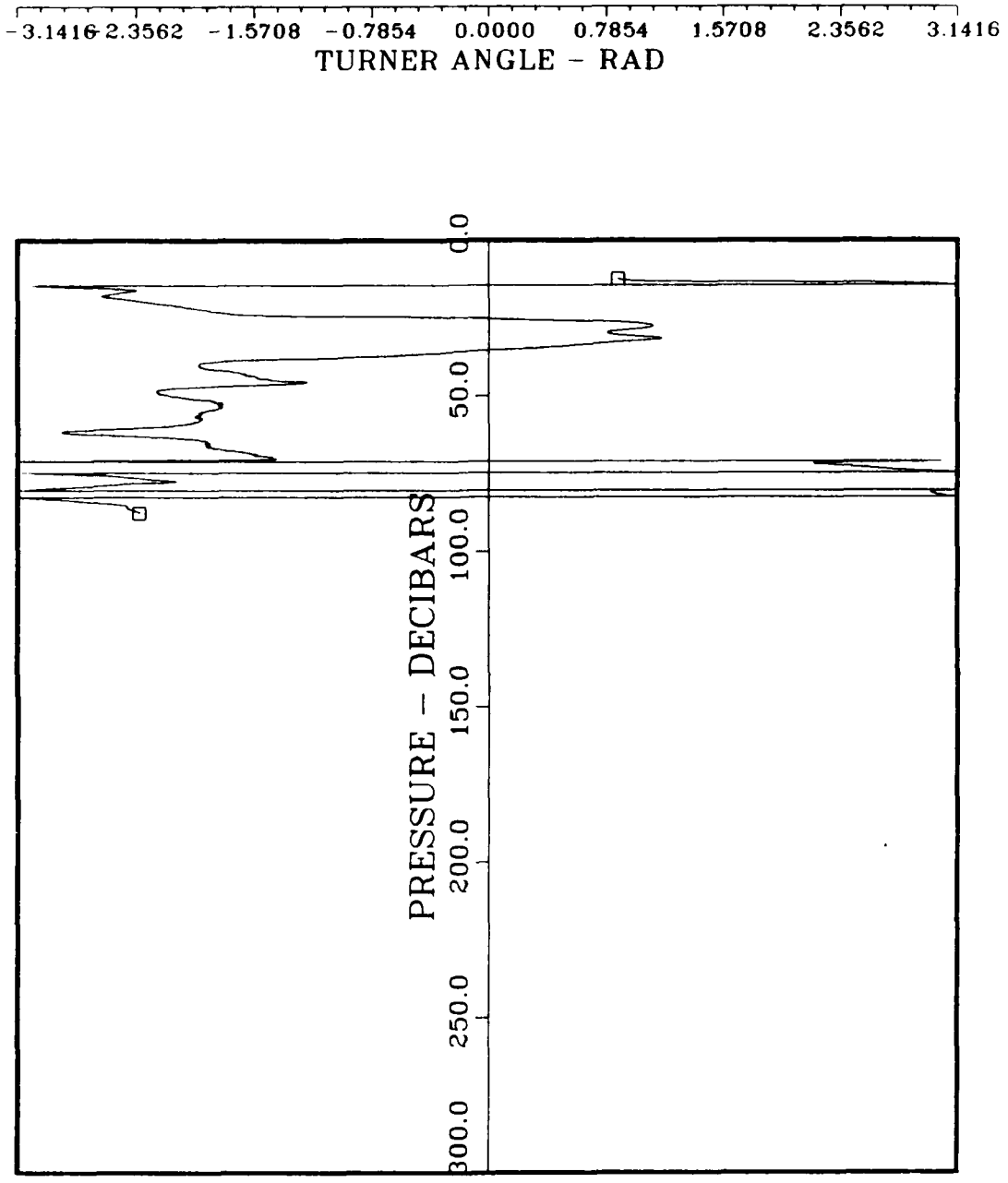
STATION	0
GROUP NUMBER	8
JULIAN DATE	121.4140
LATITUDE	38.283
LONGITUDE	-73.150

LEGEND
□ = DIRECTION
○ = SPEED



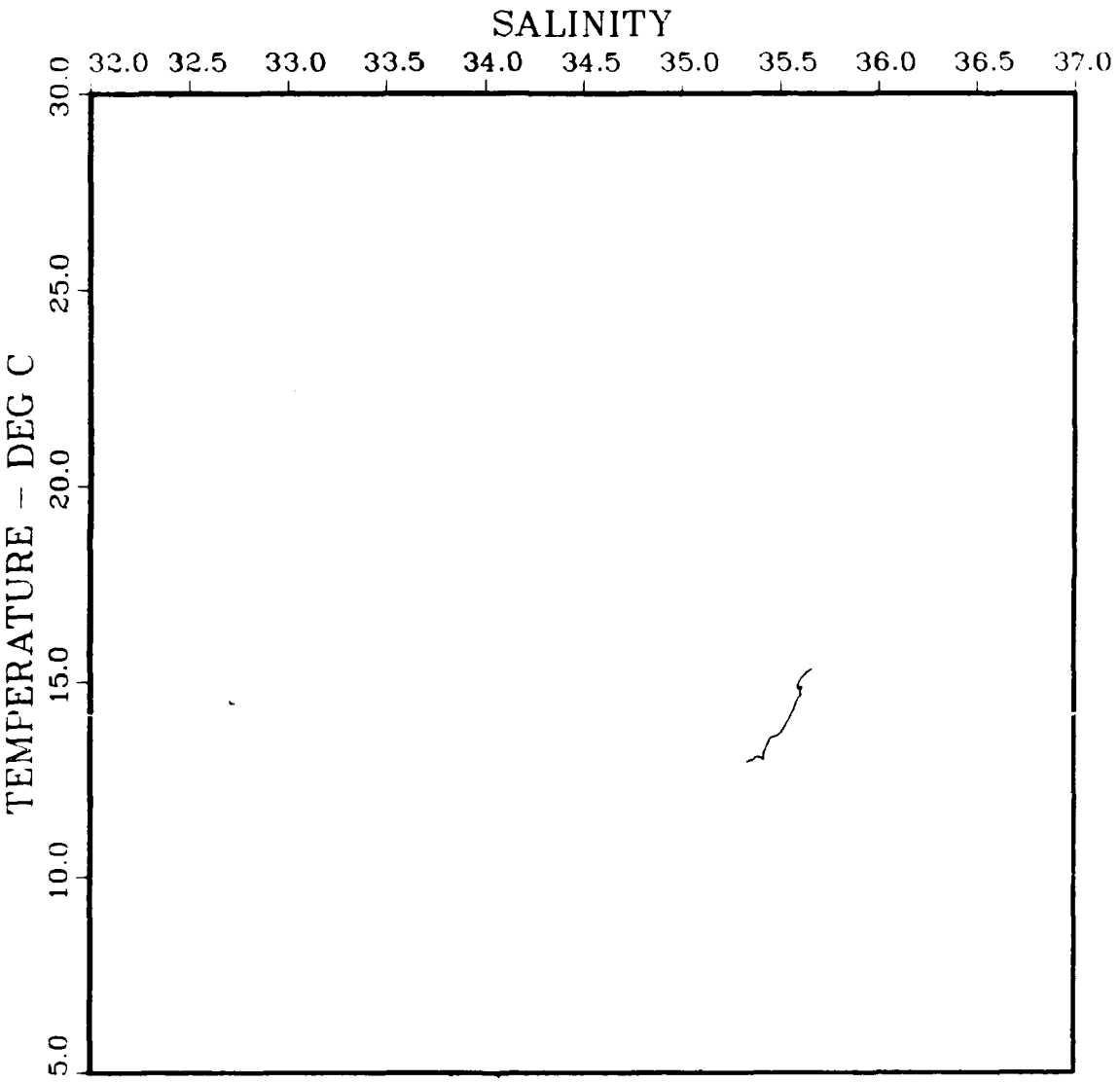
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	12
JULIAN DATE	121.4140
LATITUDE	38.283
LONGITUDE	-73.150



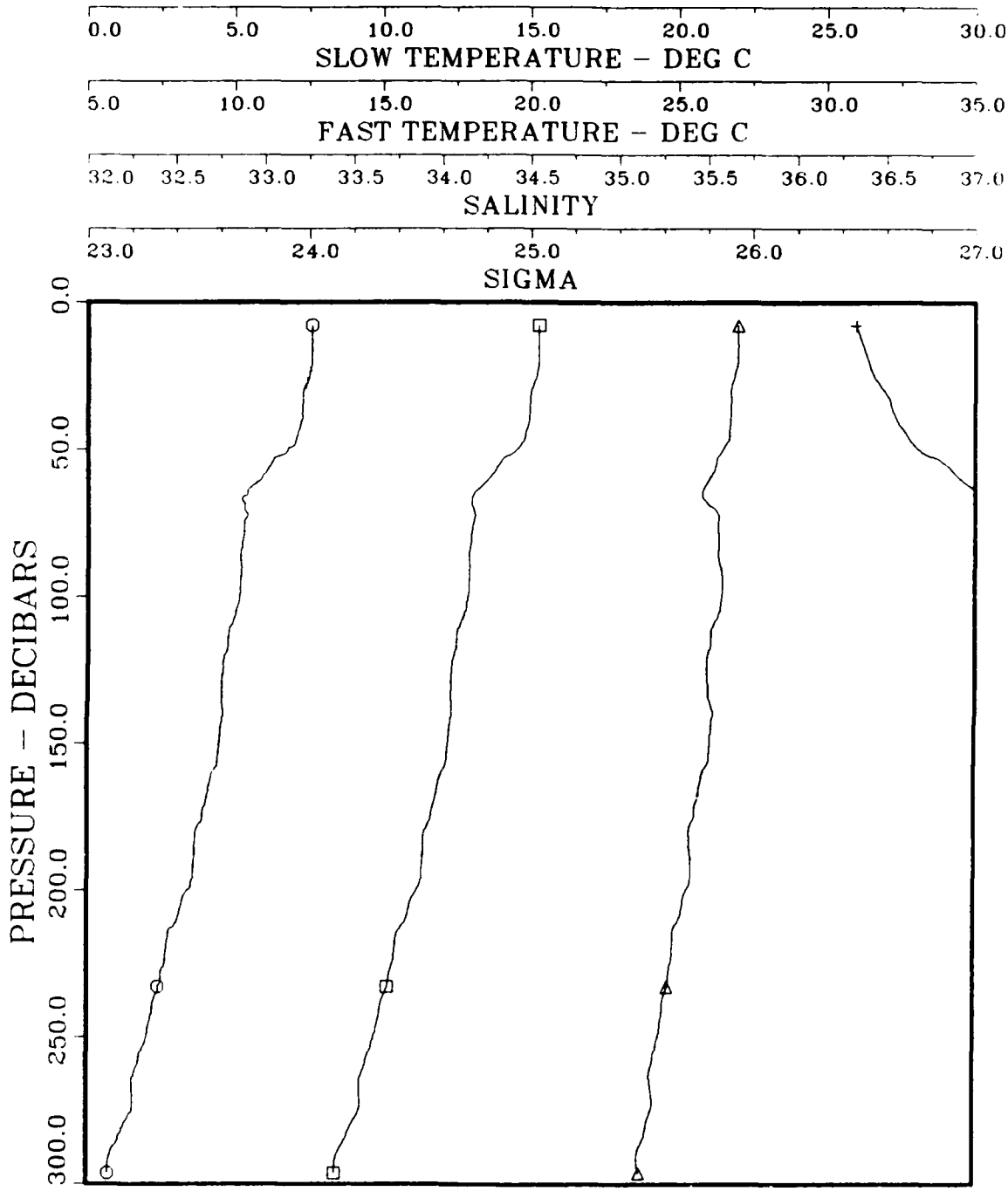
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	12
JULIAN DATE	121.4140
LATITUDE	38.283
LONGITUDE	-73.150



DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	12
JULIAN DATE	121.4140
LATITUDE	38.283
LONGITUDE	-73.150

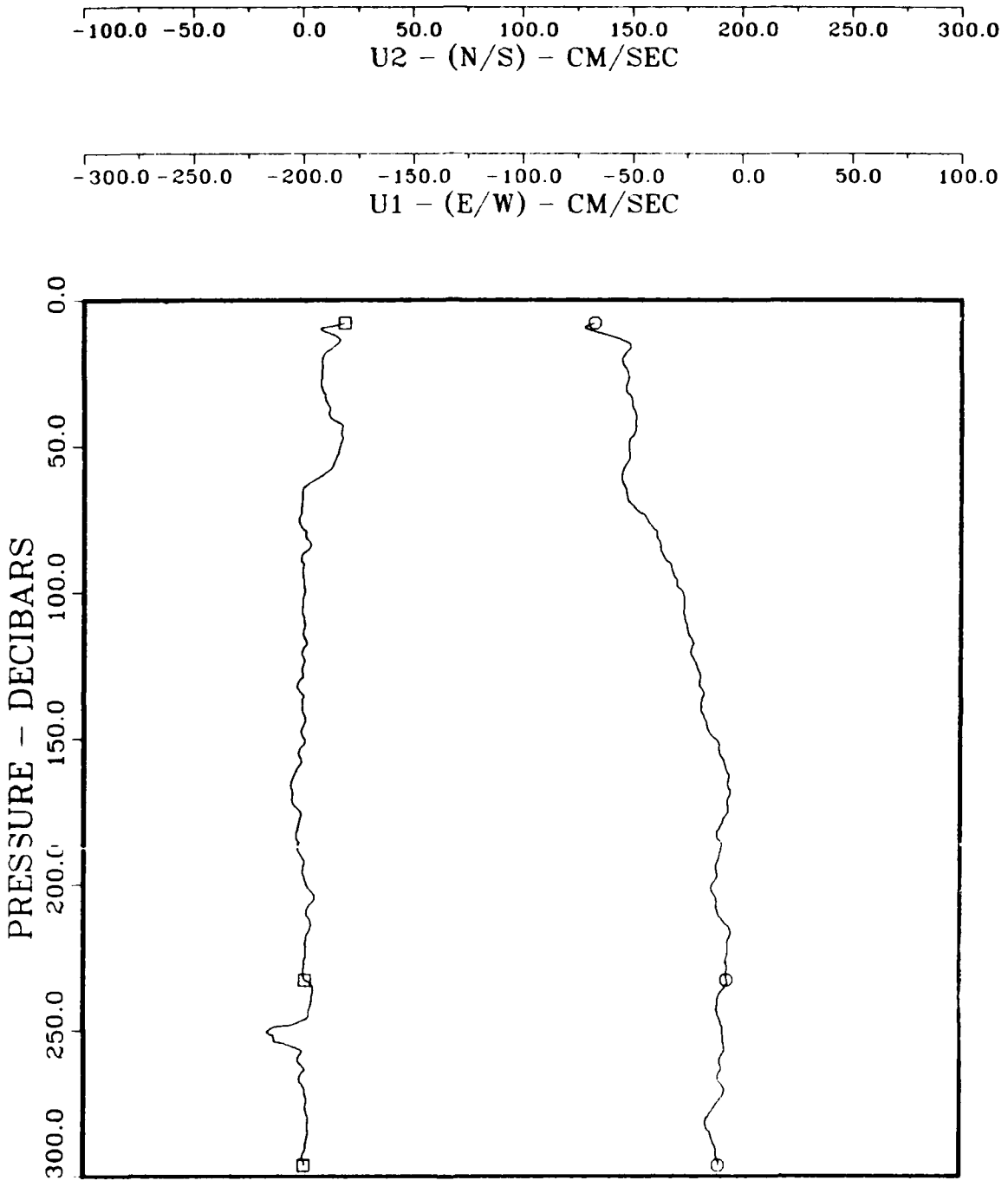


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	13
JULIAN DATE	121.4240
LATITUDE	38.282
LONGITUDE	–73.153

LEGEND

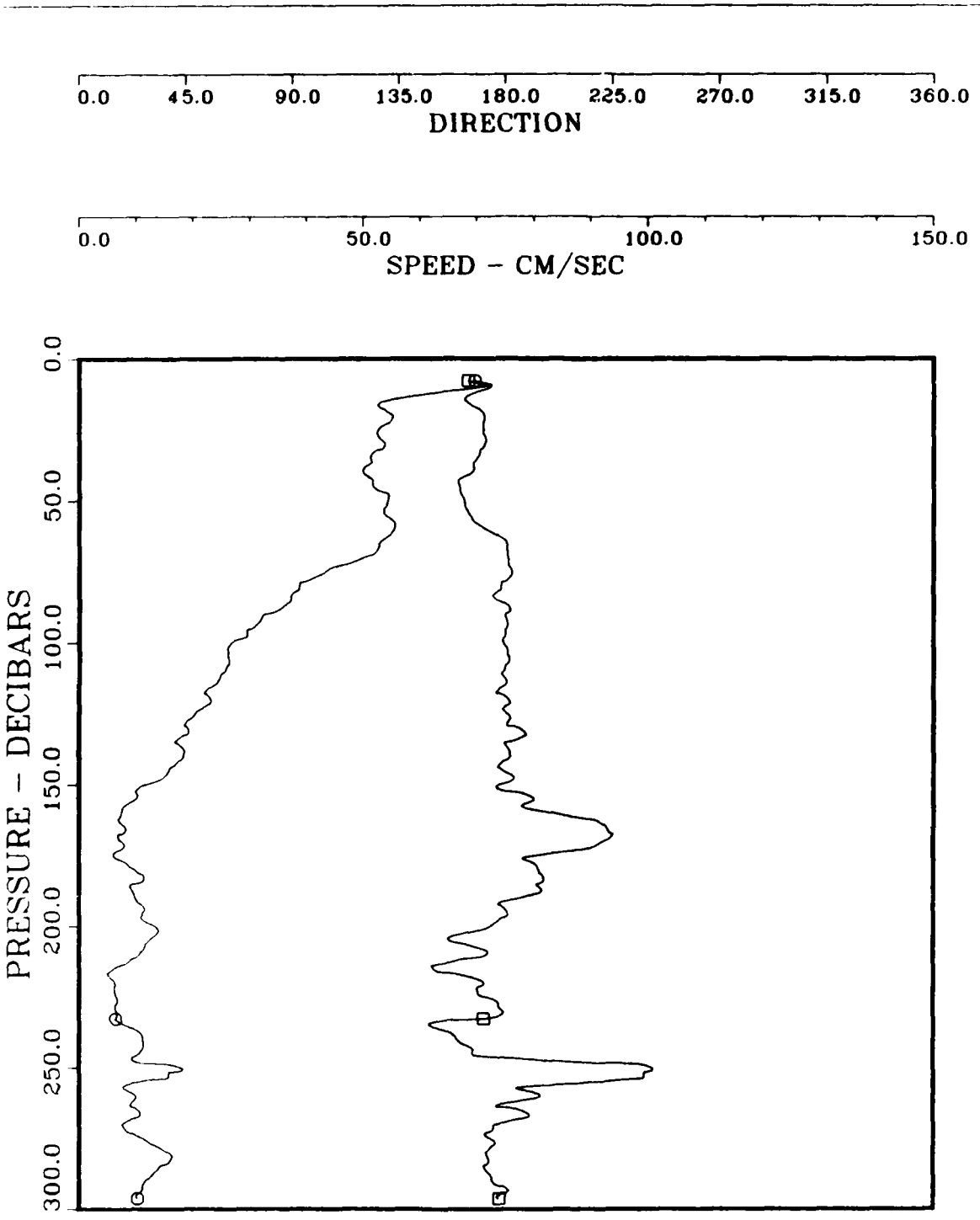
□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	9
JULIAN DATE	121.4240
LATITUDE	38.282
LONGITUDE	-73.153

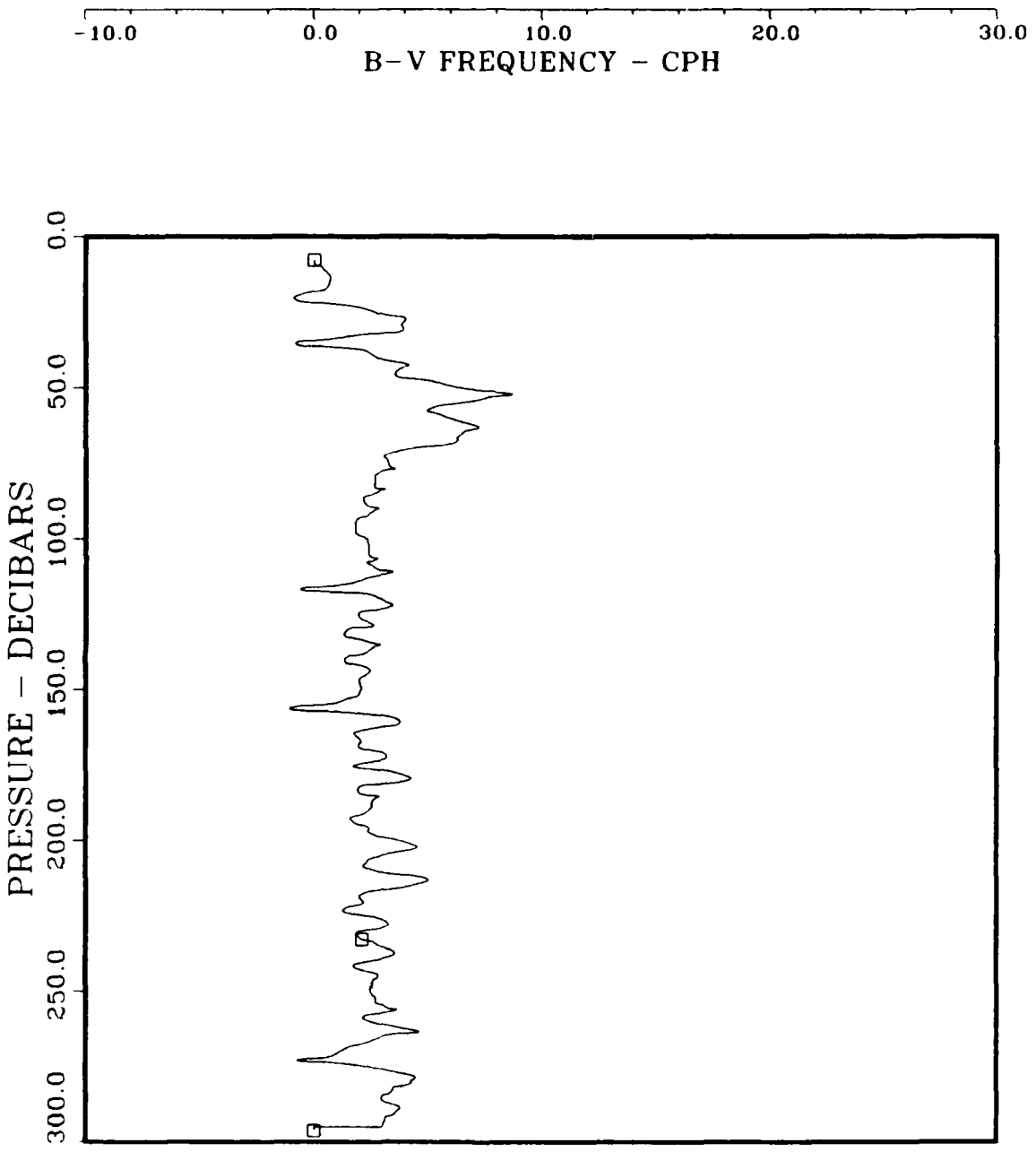
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

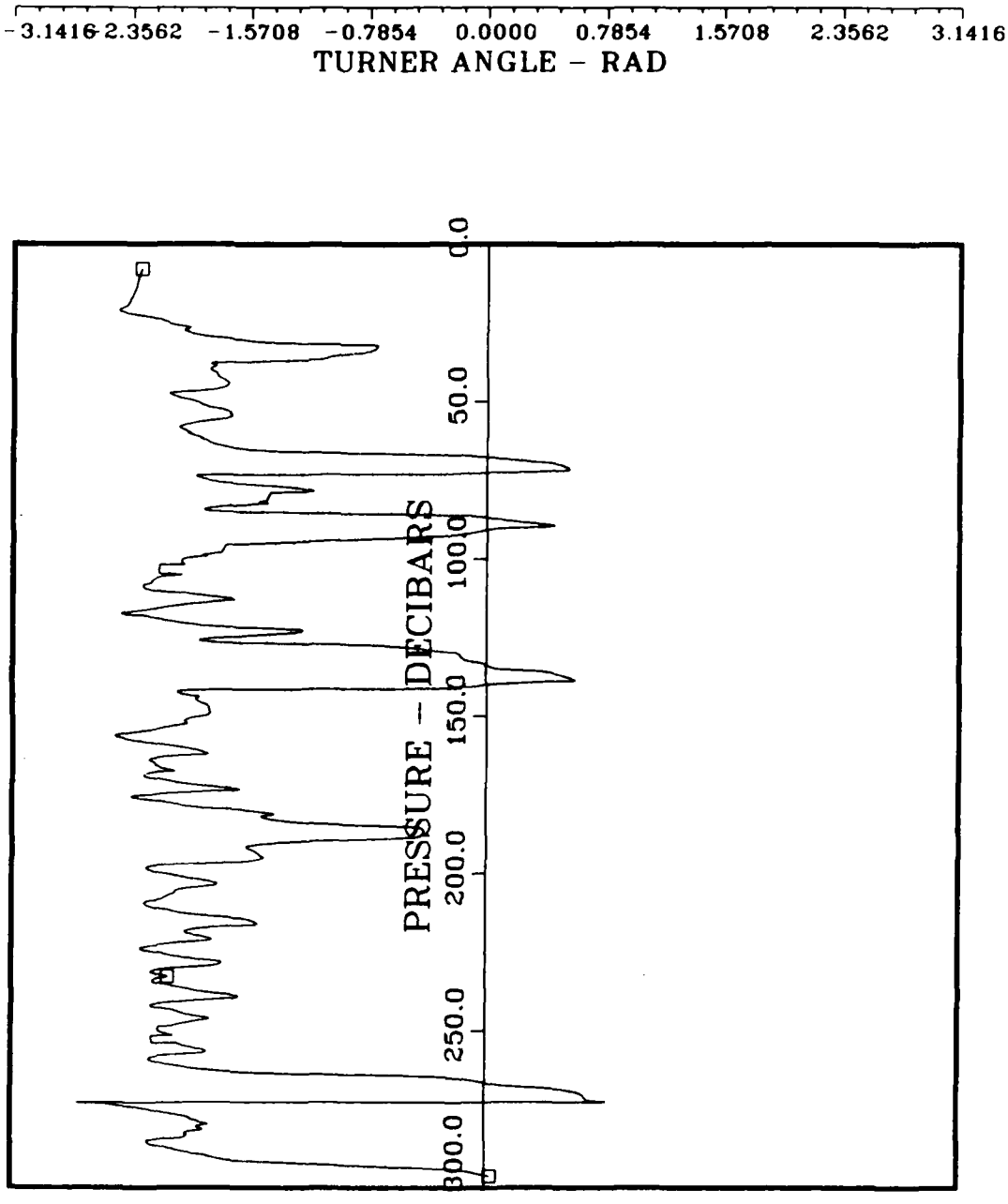
STATION	0
GROUP NUMBER	9
JULIAN DATE	121.4240
LATITUDE	38.282
LONGITUDE	-73.153

LEGEND
□ = DIRECTION
○ = SPEED



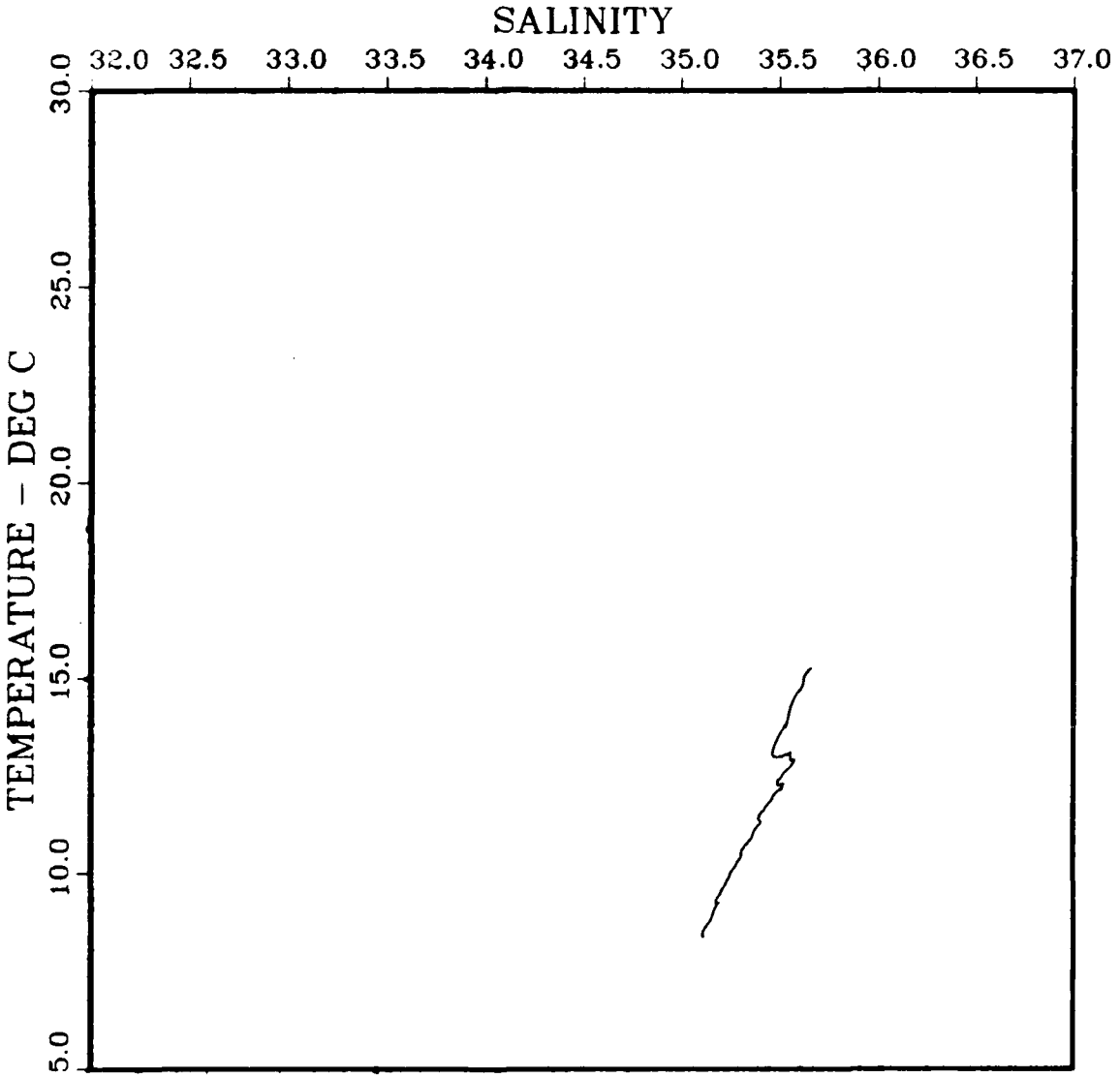
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	13
JULIAN DATE	121.4240
LATITUDE	38.282
LONGITUDE	-73.153



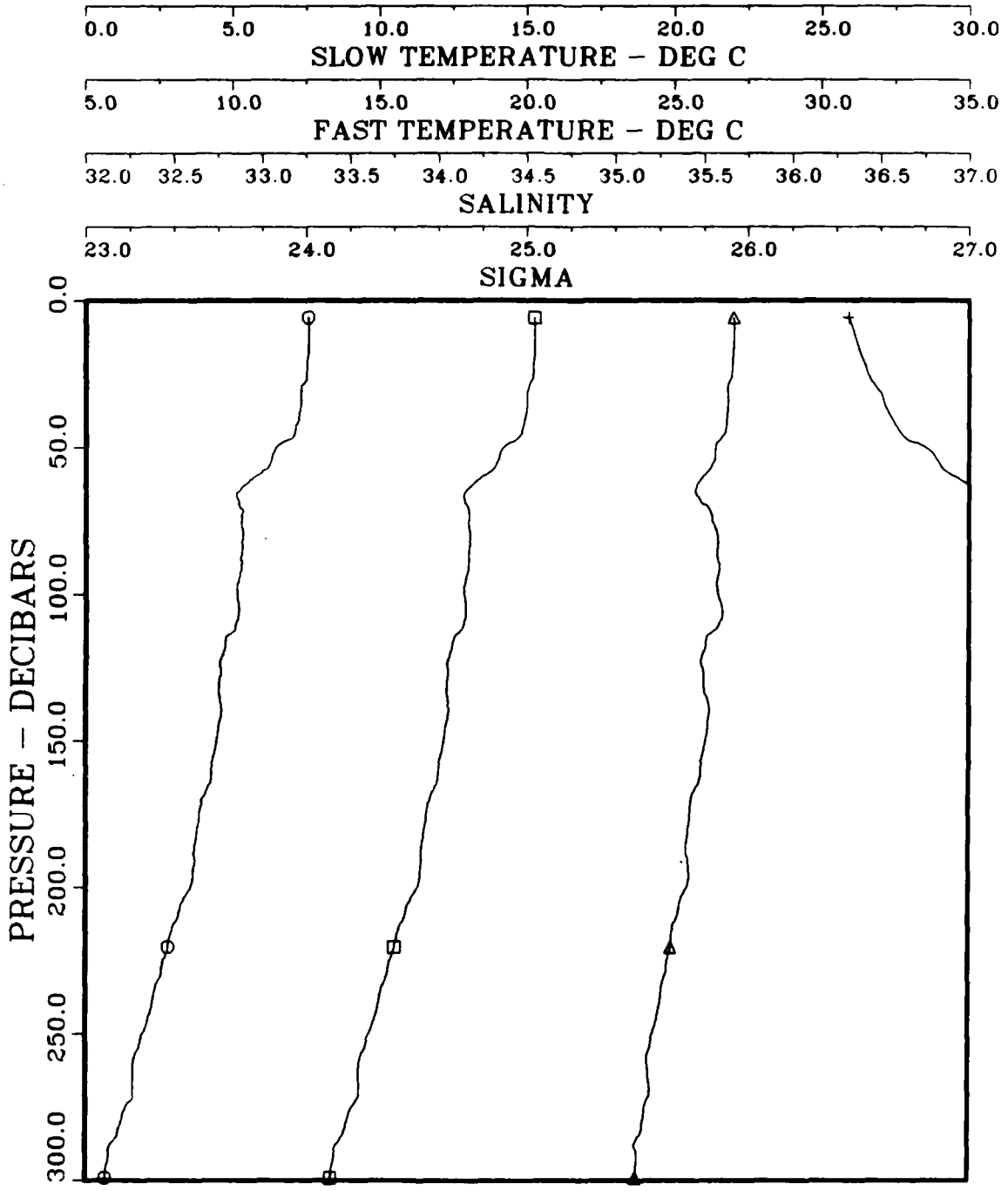
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	13
JULIAN DATE	121.4240
LATITUDE	38.282
LONGITUDE	-73.153



DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	13
JULIAN DATE	121.4240
LATITUDE	38.282
LONGITUDE	−73.153

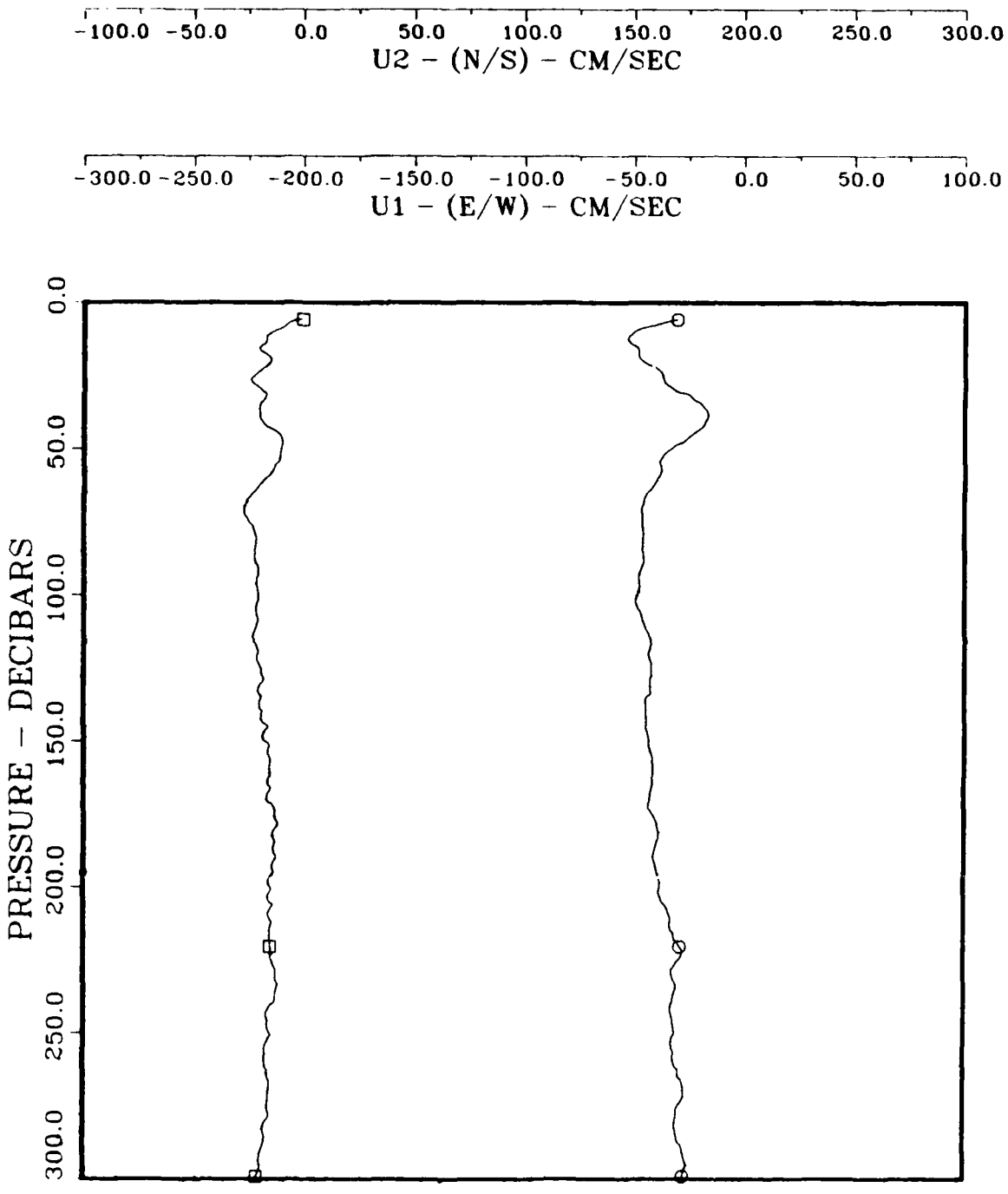


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	14
JULIAN DATE	121.4330
LATITUDE	38.280
LONGITUDE	–73.158

LEGEND

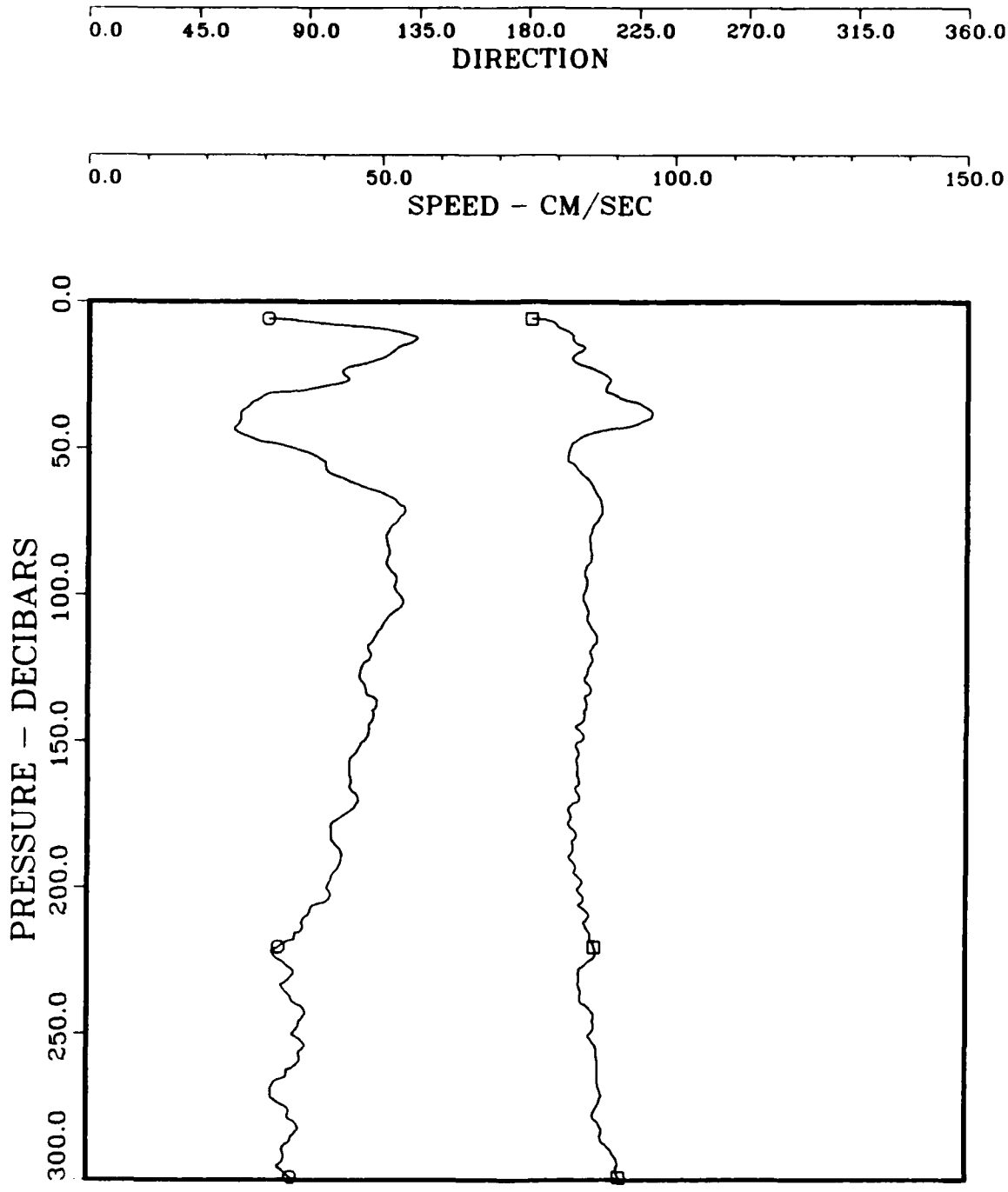
□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	10
JULIAN DATE	121.4330
LATITUDE	38.280
LONGITUDE	-73.158

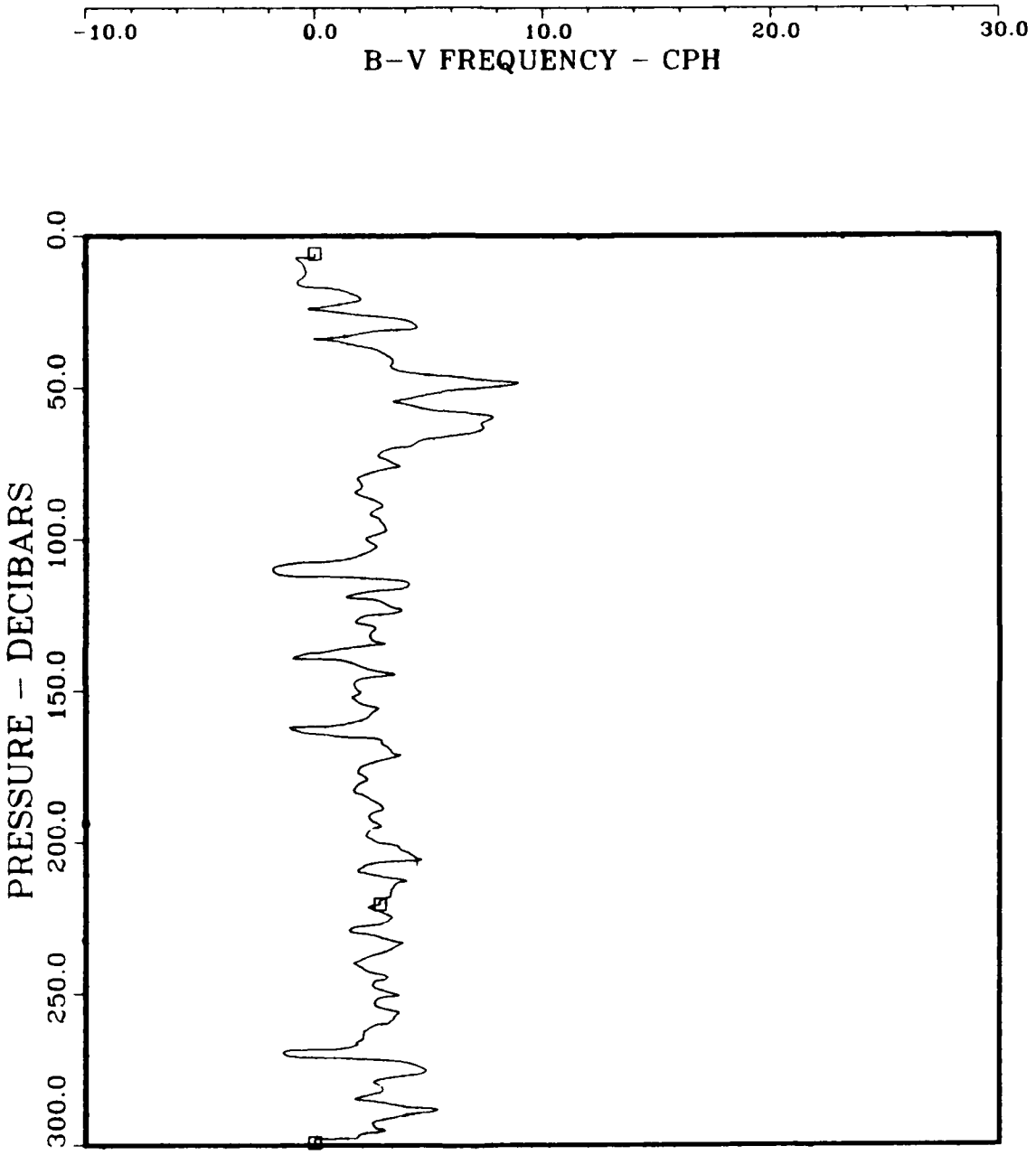
LEGEND
□ = U2
○ = U1



DYNAMICS OF CHEMICAL FRONTS - 1985

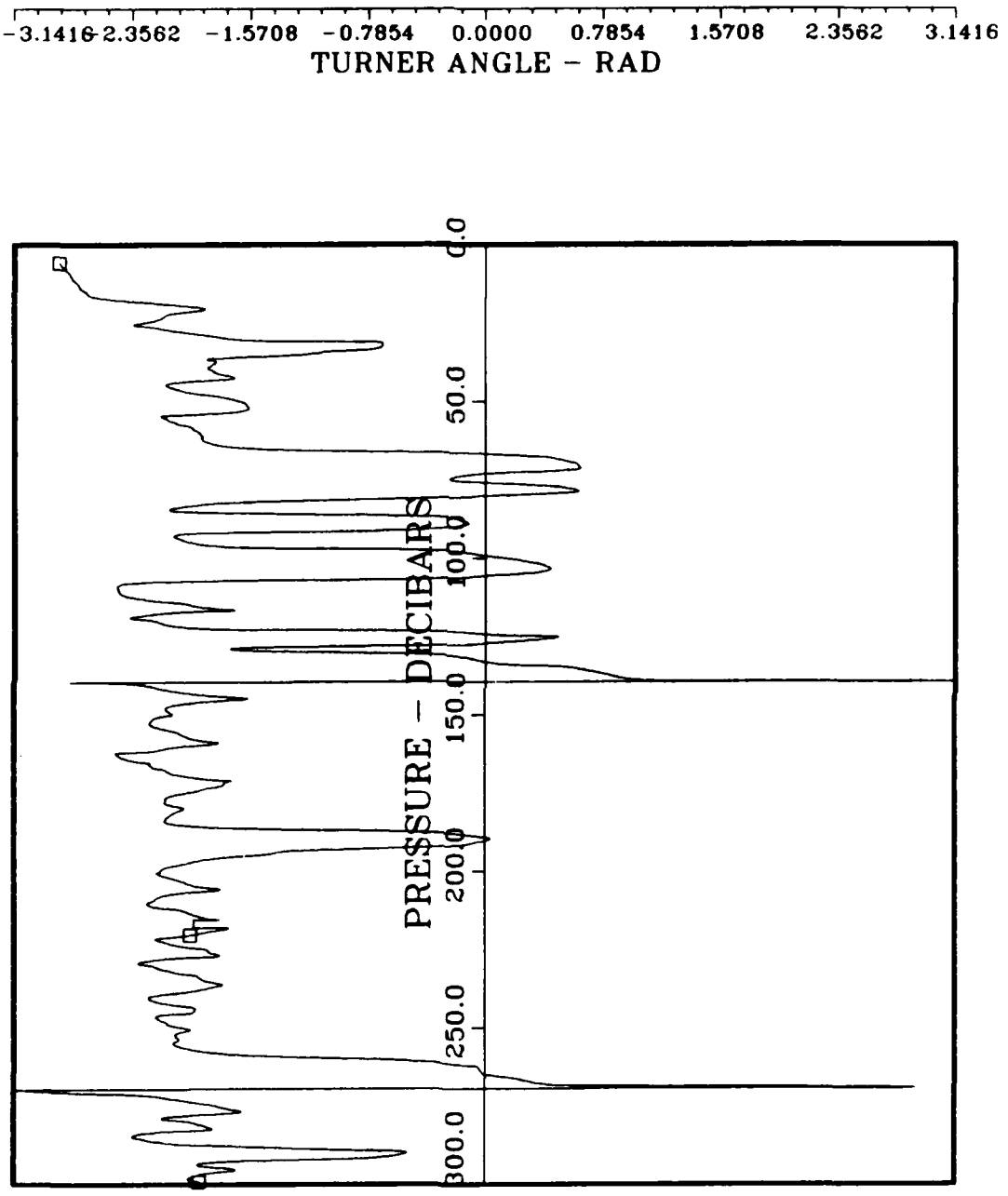
STATION	0
GROUP NUMBER	10
JULIAN DATE	121.4330
LATITUDE	38.280
LONGITUDE	-73.158

LEGEND
□ = DIRECTION
○ = SPEED



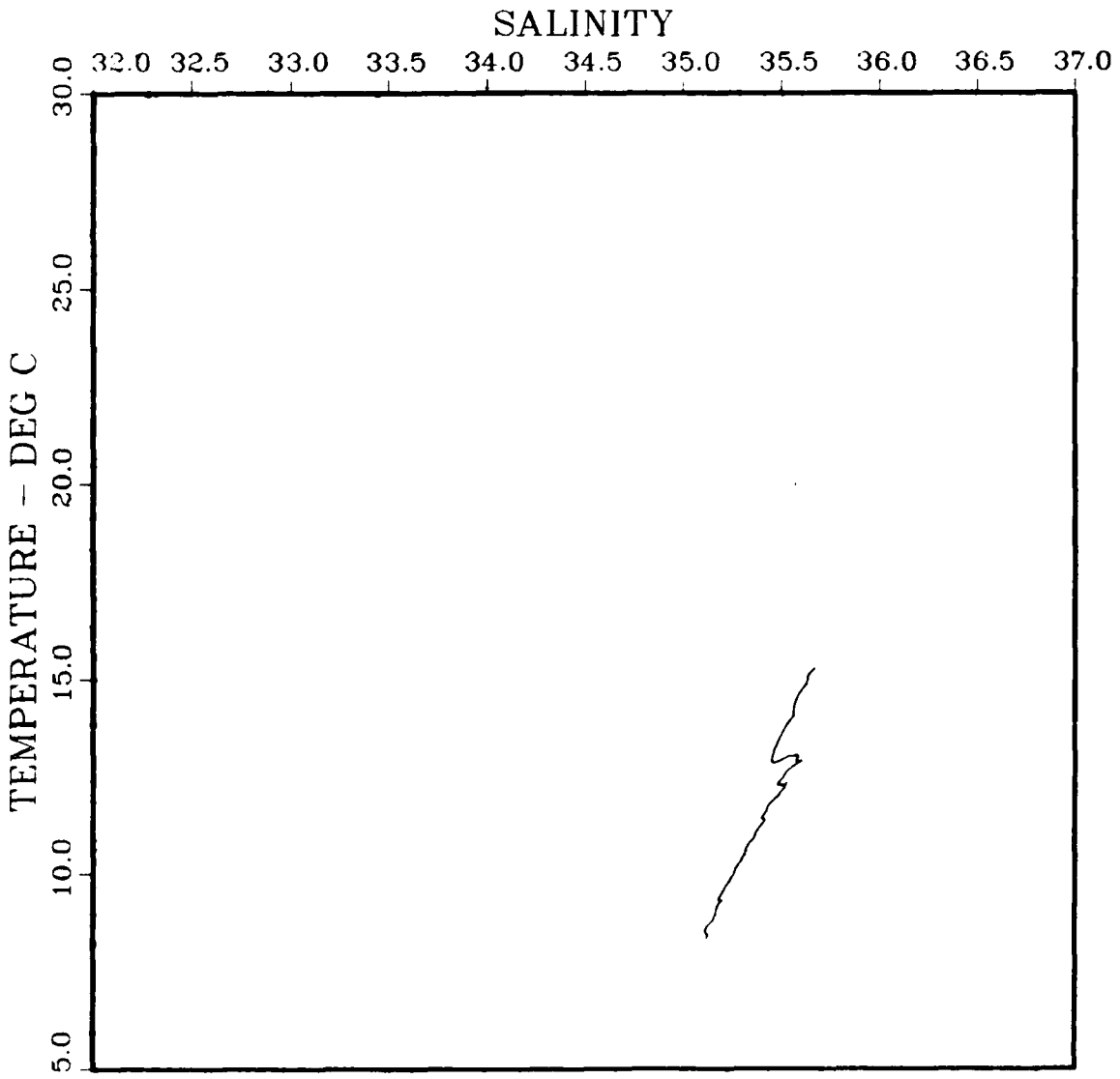
DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	14
JULIAN DATE	121.4330
LATITUDE	38.280
LONGITUDE	-73.158



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	14
JULIAN DATE	121.4330
LATITUDE	38.280
LONGITUDE	-73.158



DYNAMICS OF CHEMICAL FRONTS

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JULIAN DATE	121.4330
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LONGITUDE	−73.158

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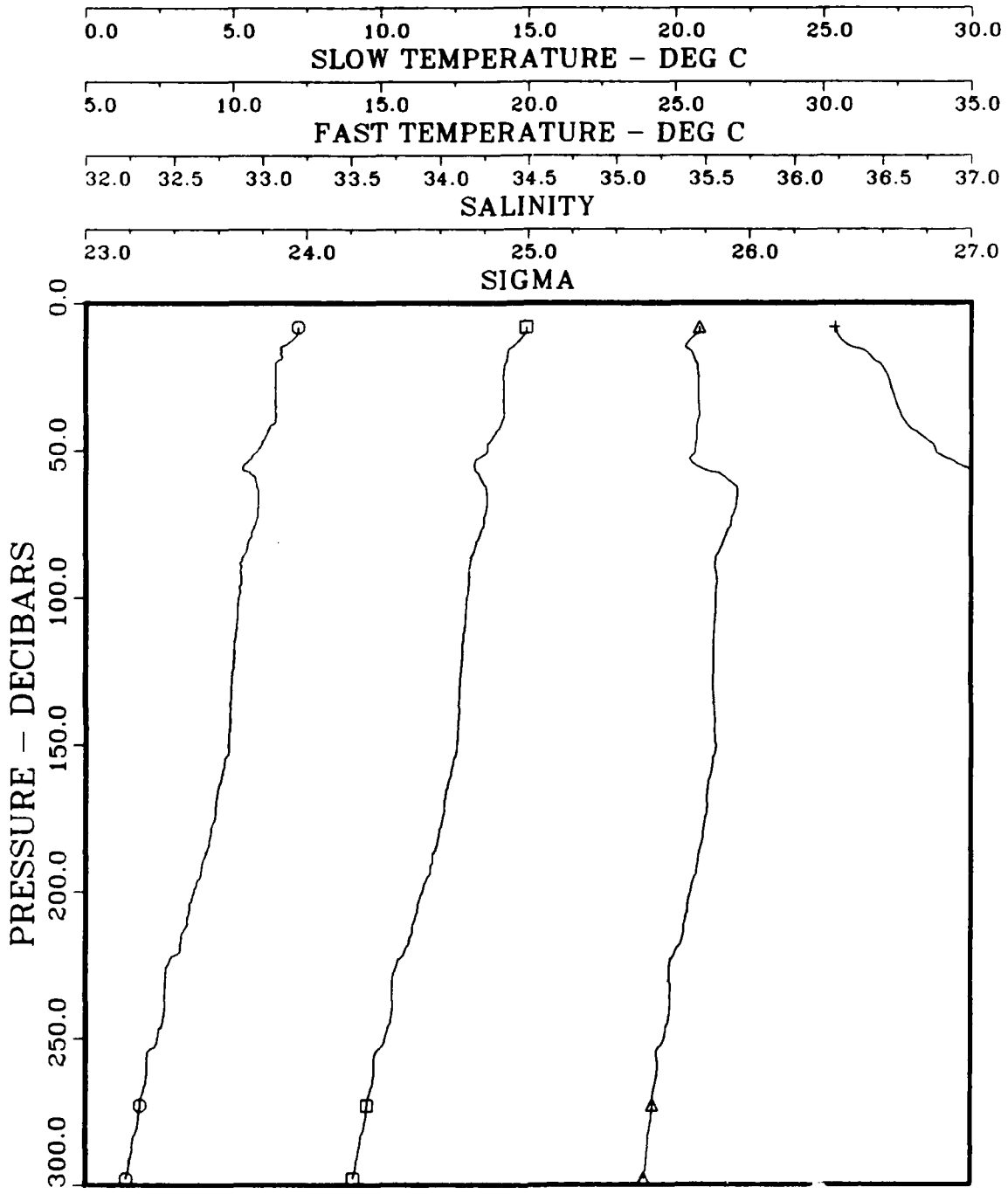
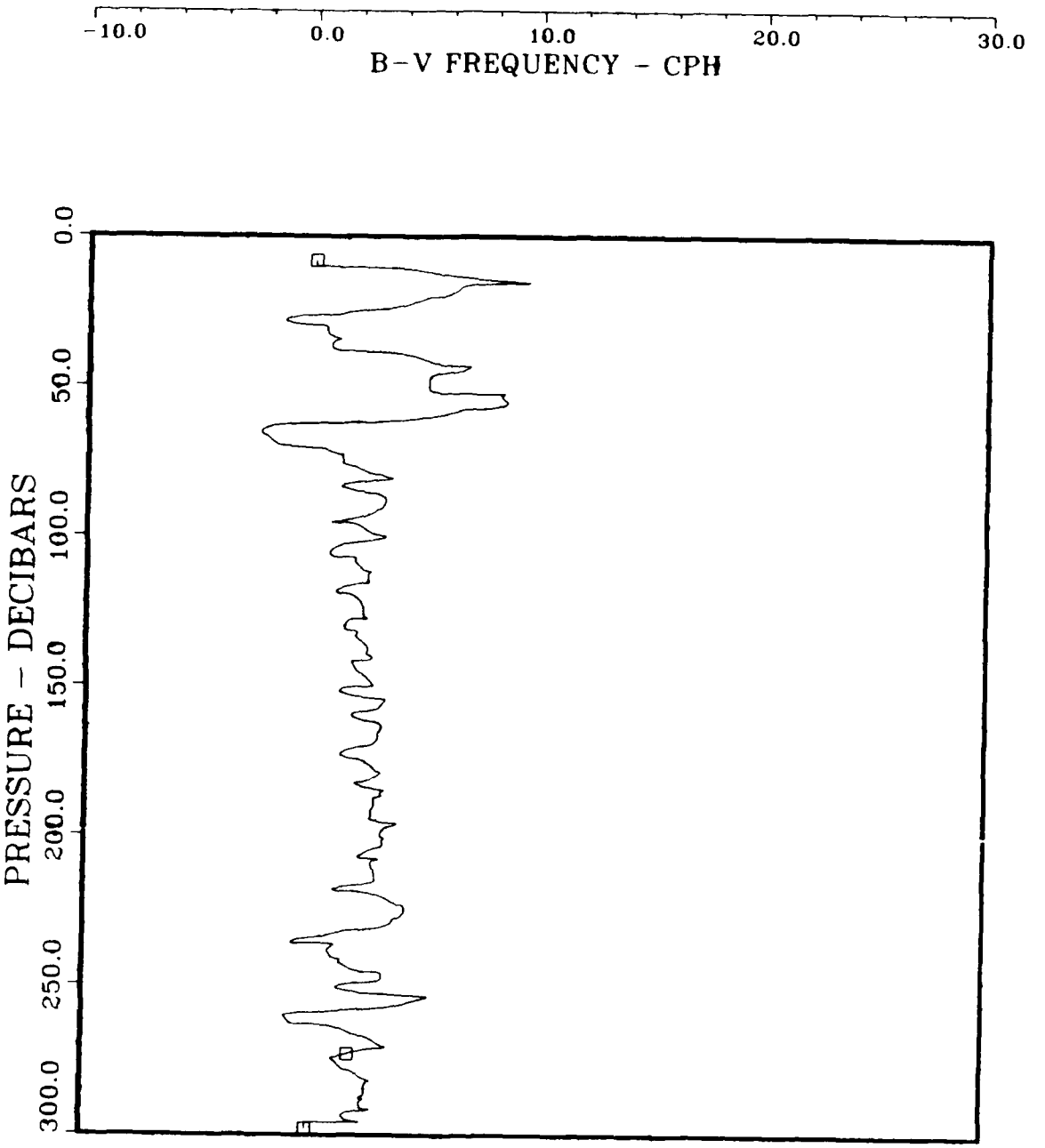


DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	15
JULIAN DATE	122.6850
LATITUDE	38.355
LONGITUDE	–72.690

LEGEND

□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

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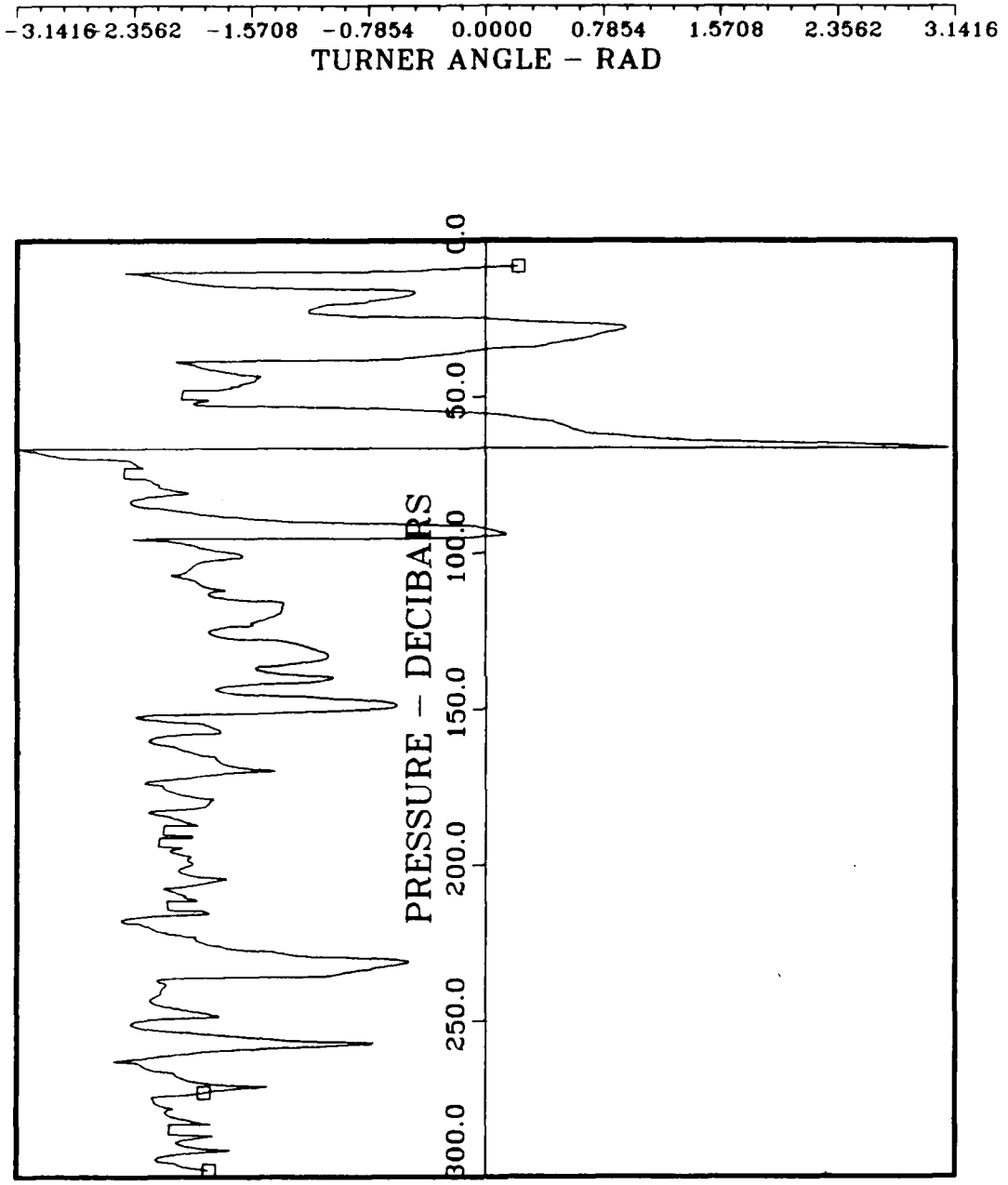

DYNAMICS OF CHEMICAL FRONTS - 1985

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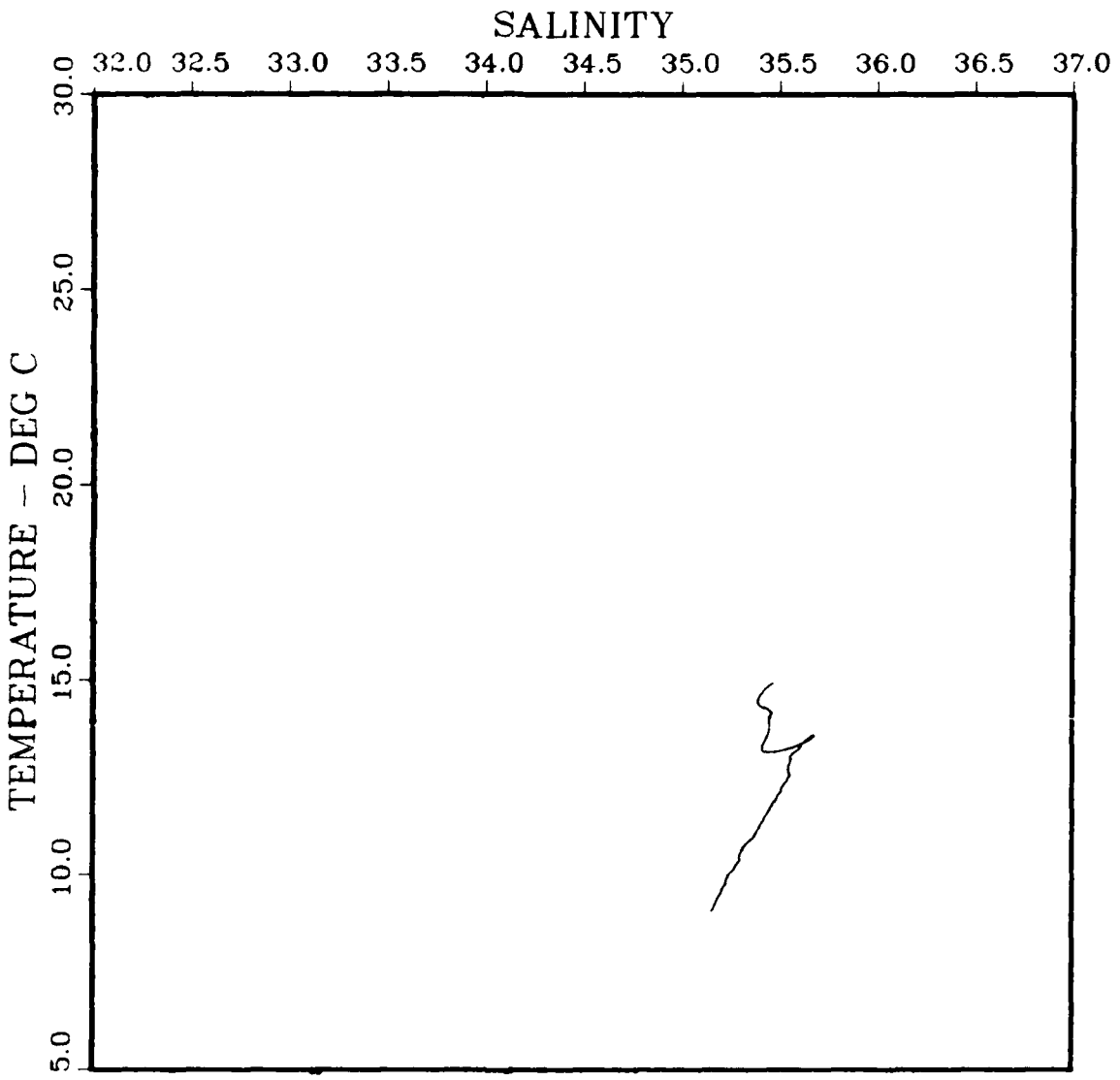
LONGITUDE	-72.690



DYNAMICS OF CHEMICAL FRONTS

STATION	0
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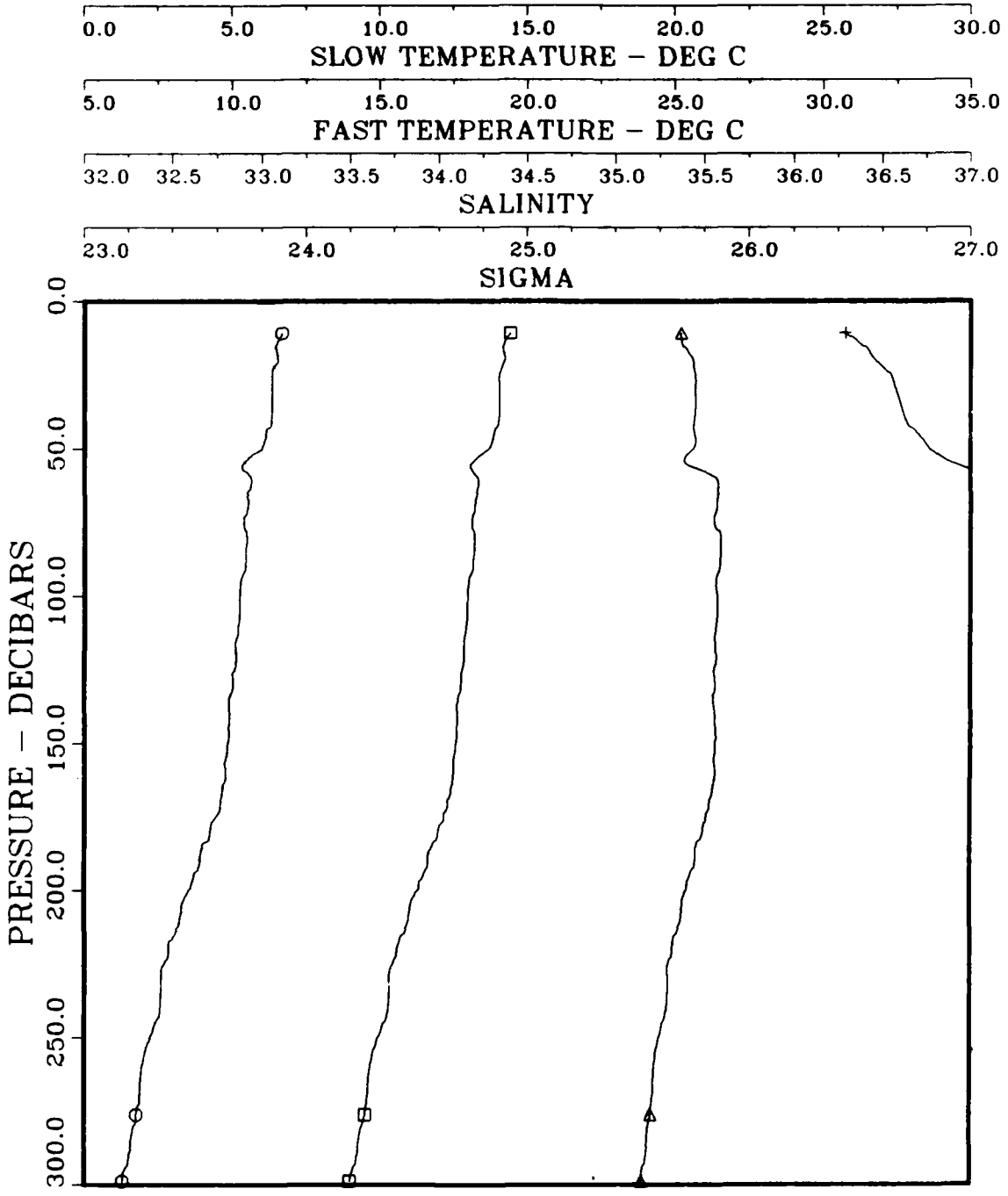

DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	16
JULIAN DATE	122.6940
LATITUDE	38.343
LONGITUDE	–72.703

LEGEND

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△ = SALINITY
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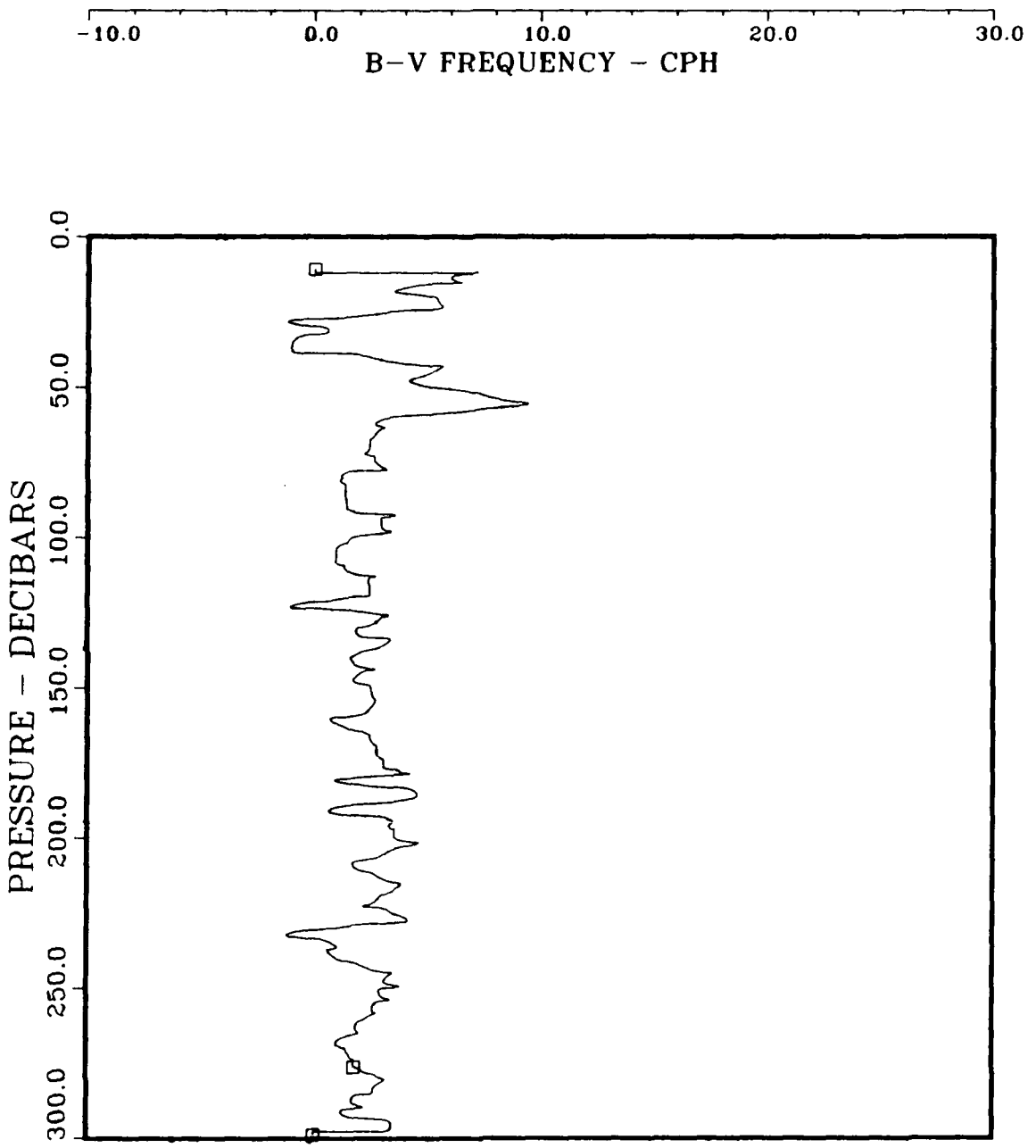

DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	16
JULIAN DATE	122.6940
LATITUDE	38.343
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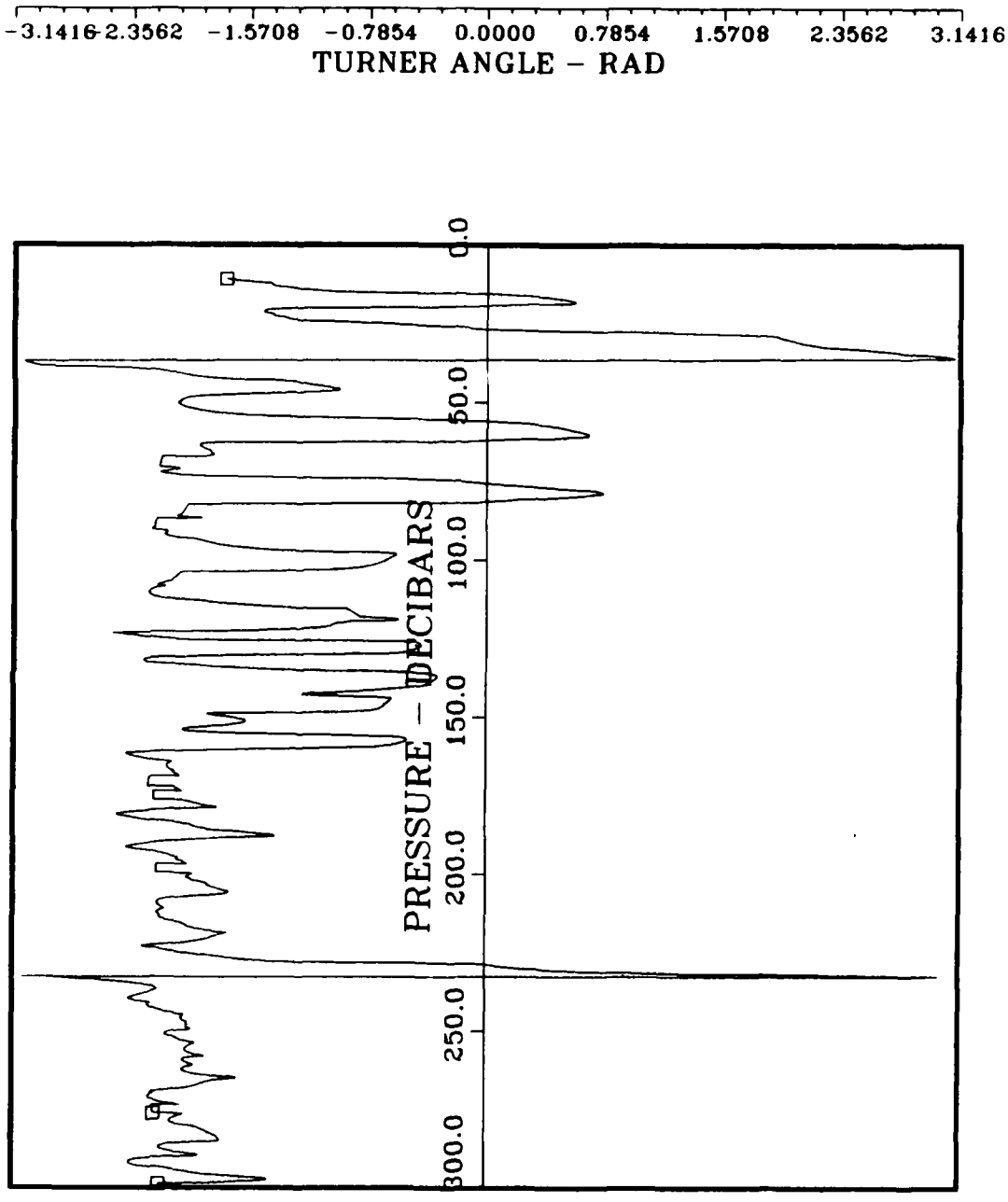

DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	16
JULIAN DATE	122.6940
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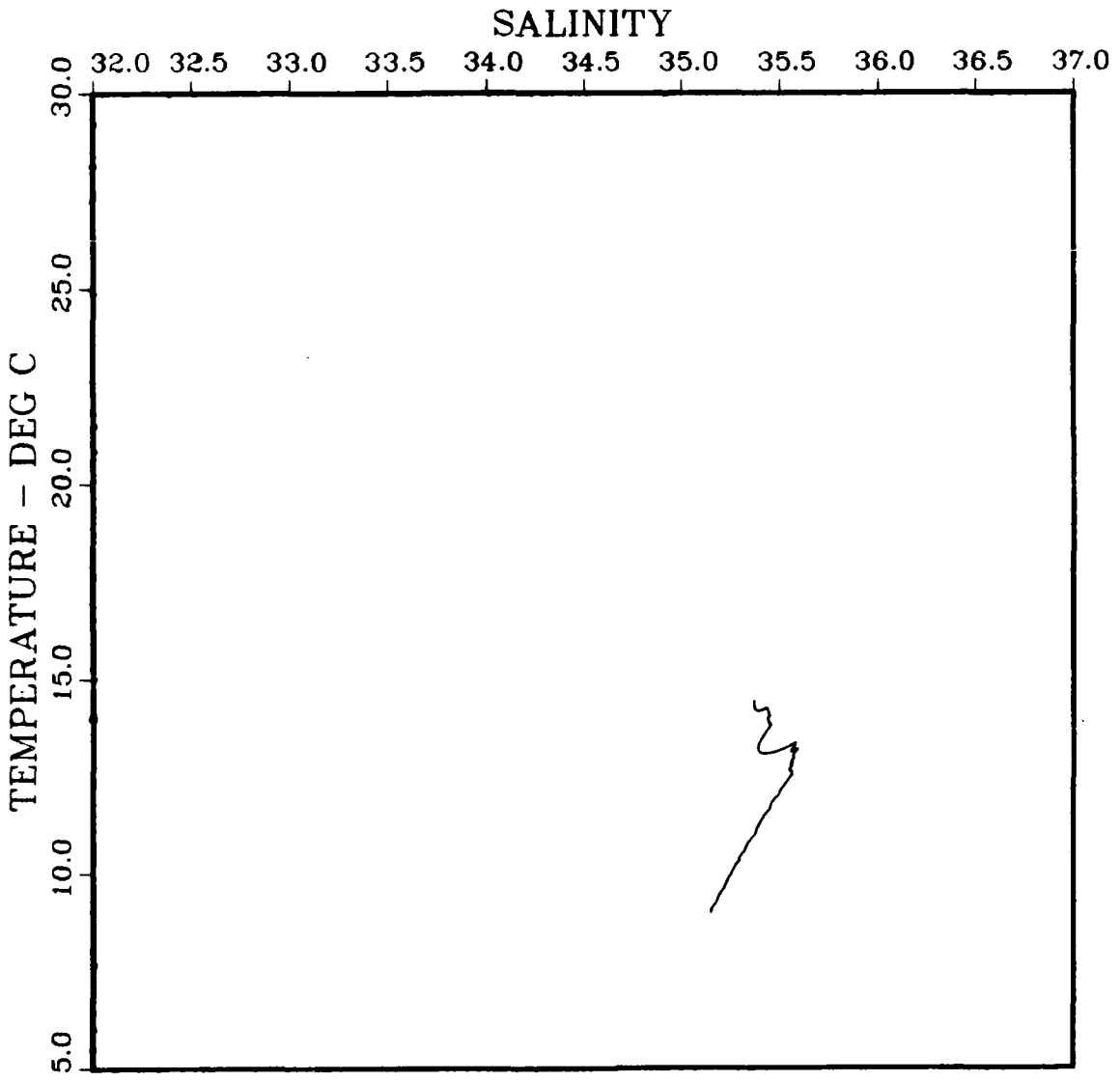

DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	16
JULIAN DATE	122.6940
LATITUDE	38.343
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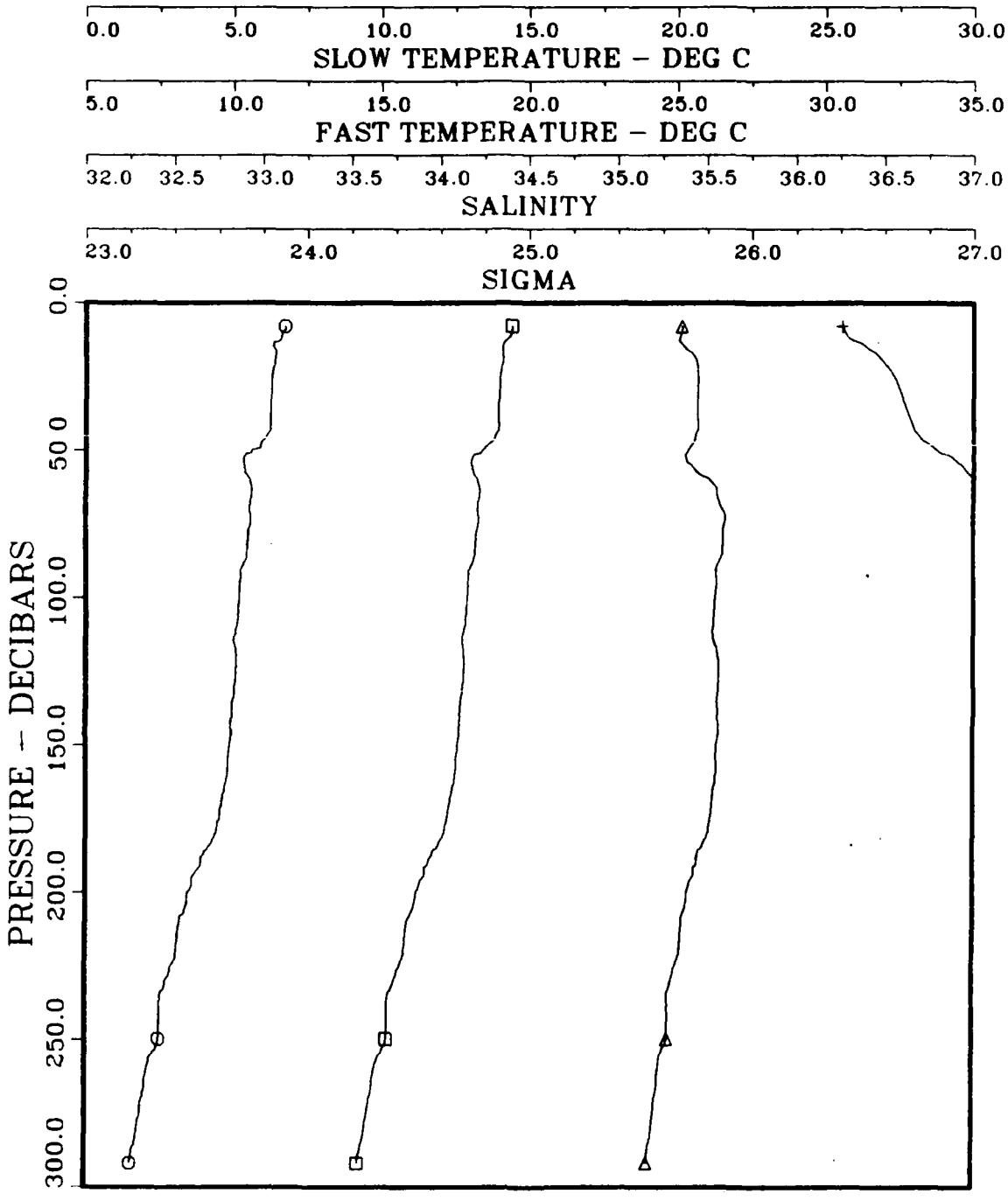

DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	17
JULIAN DATE	122.7030
LATITUDE	38.342
LONGITUDE	–72.707

LEGEND

□ = SLOW TEMPERATURE
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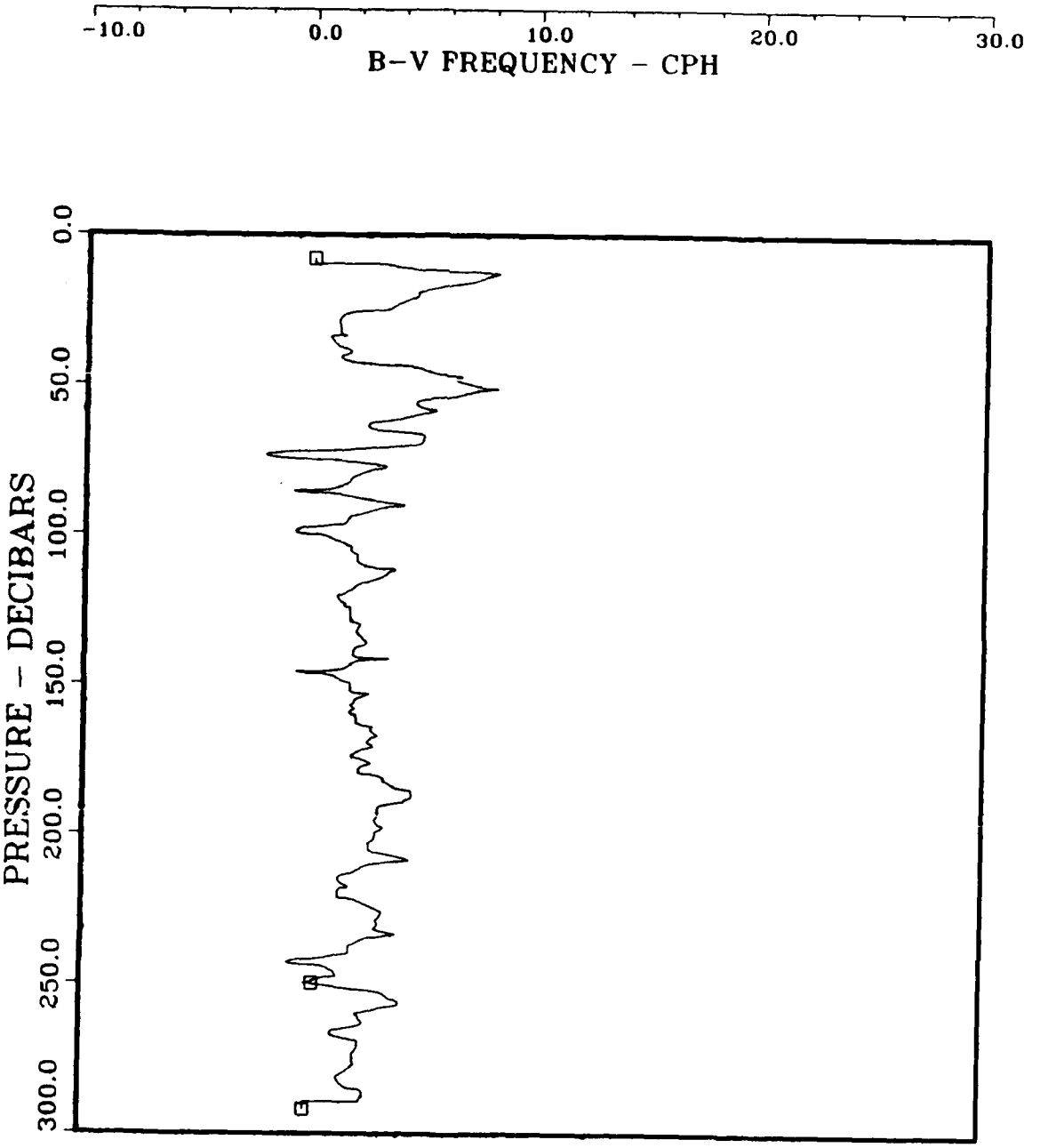
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

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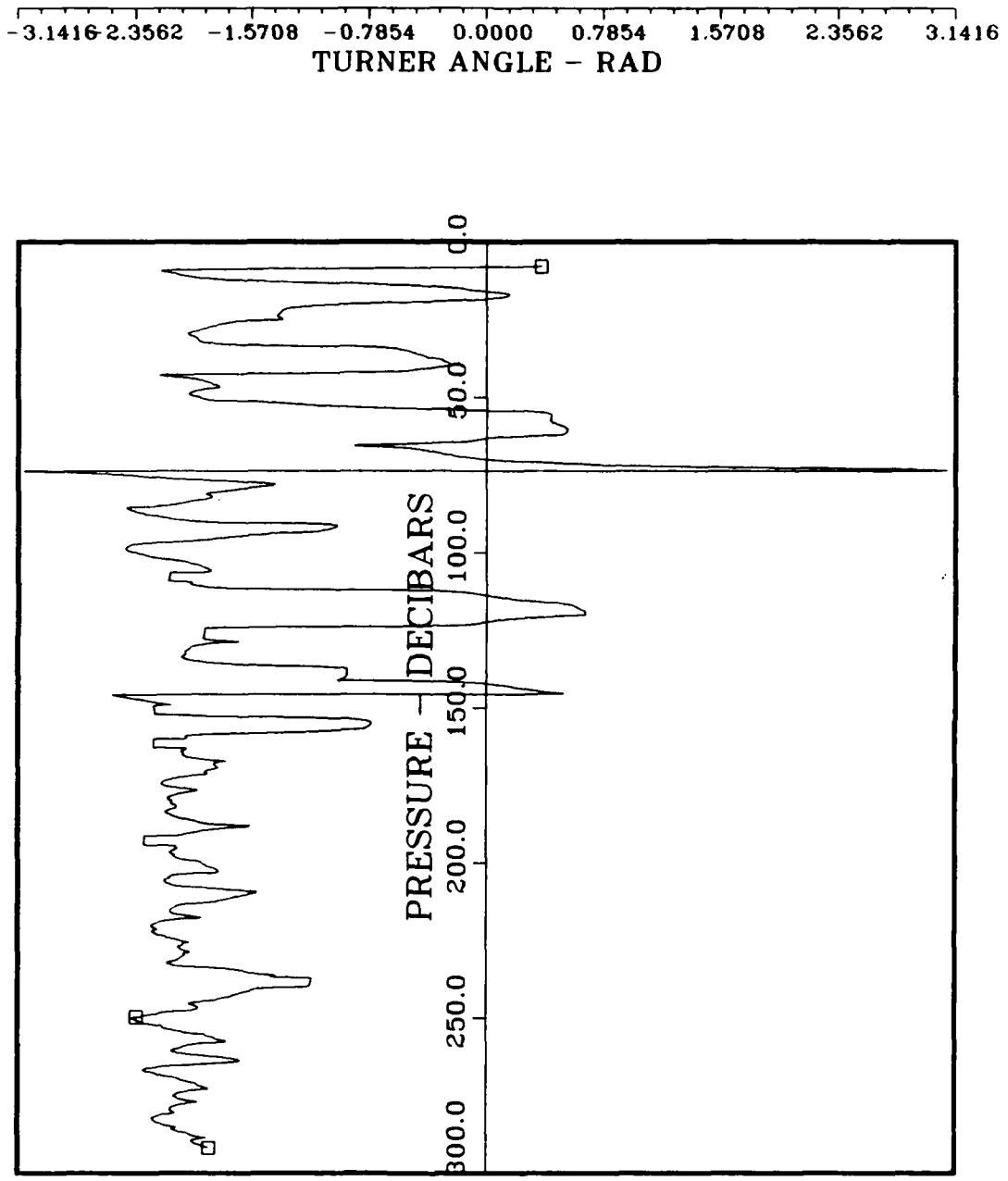

DYNAMICS OF CHEMICAL FRONTS - 1985

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LATITUDE	38.342
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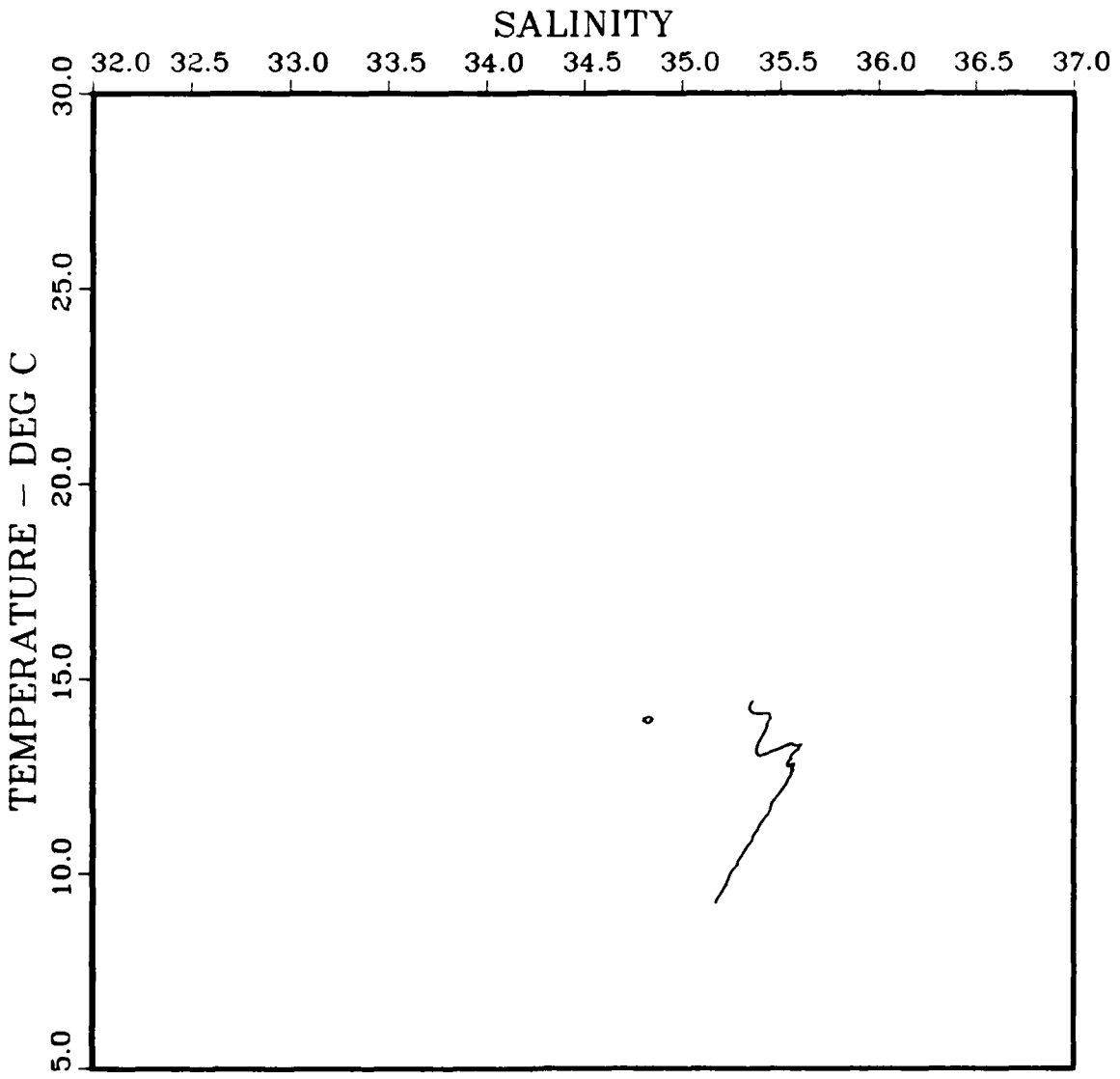
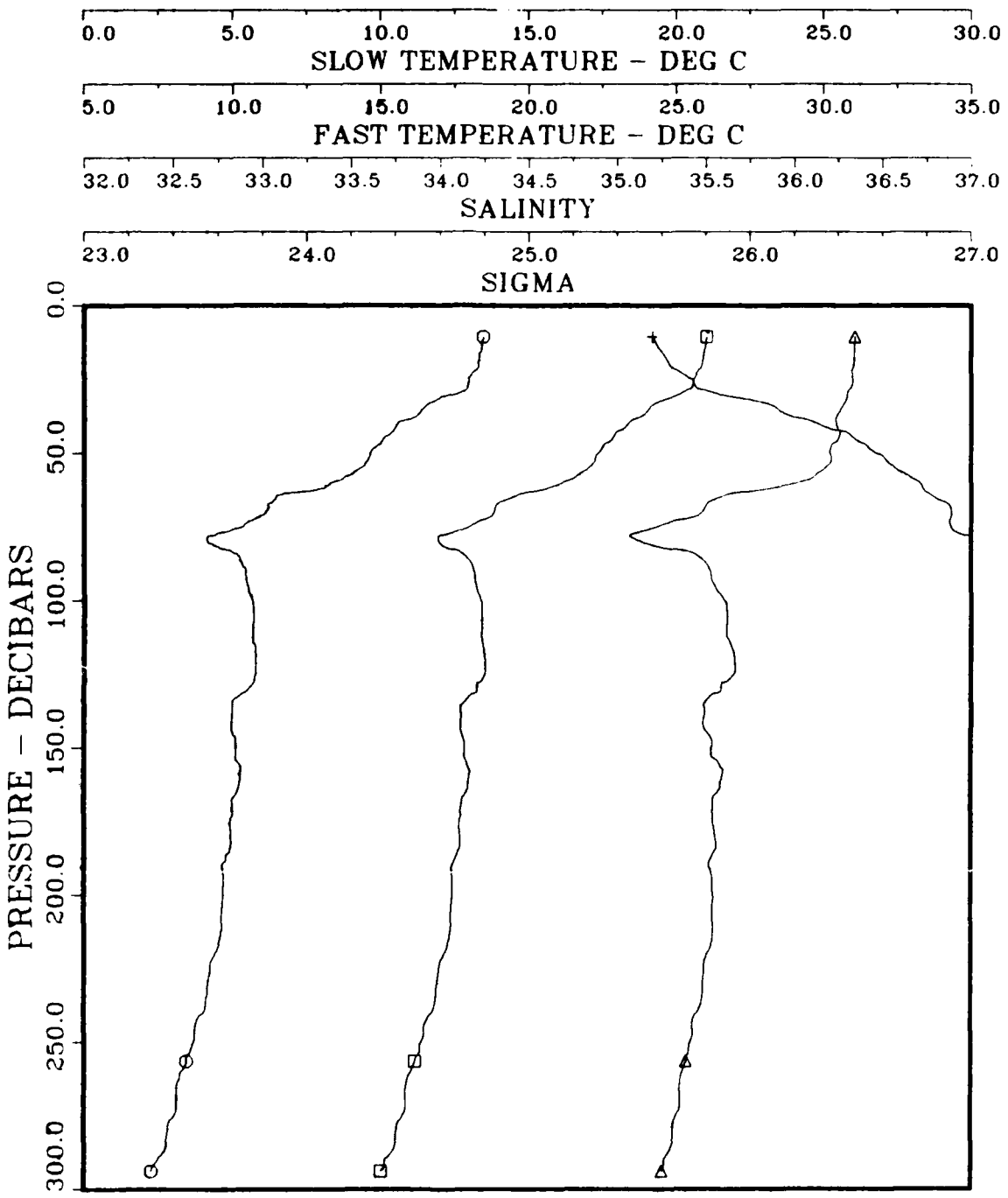


DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	17
JULIAN DATE	122.7030
LATITUDE	38.342
LONGITUDE	−72.707

STATION 6

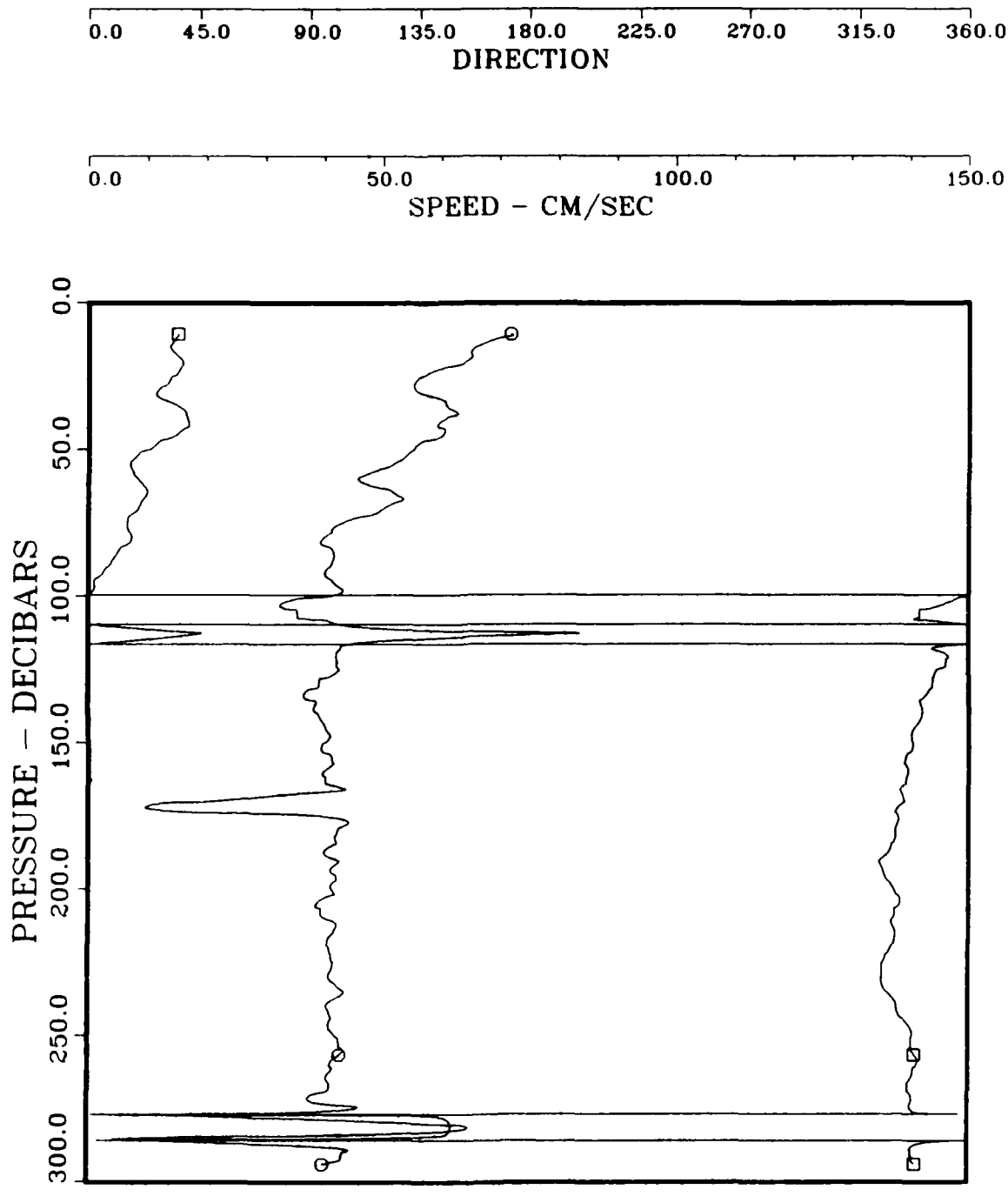


DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	18
JULIAN DATE	122.9590
LATITUDE	38.100
LONGITUDE	-72.510

LEGEND

□ = SLOW TEMPERATURE
○ = FAST TEMPERATURE
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	18
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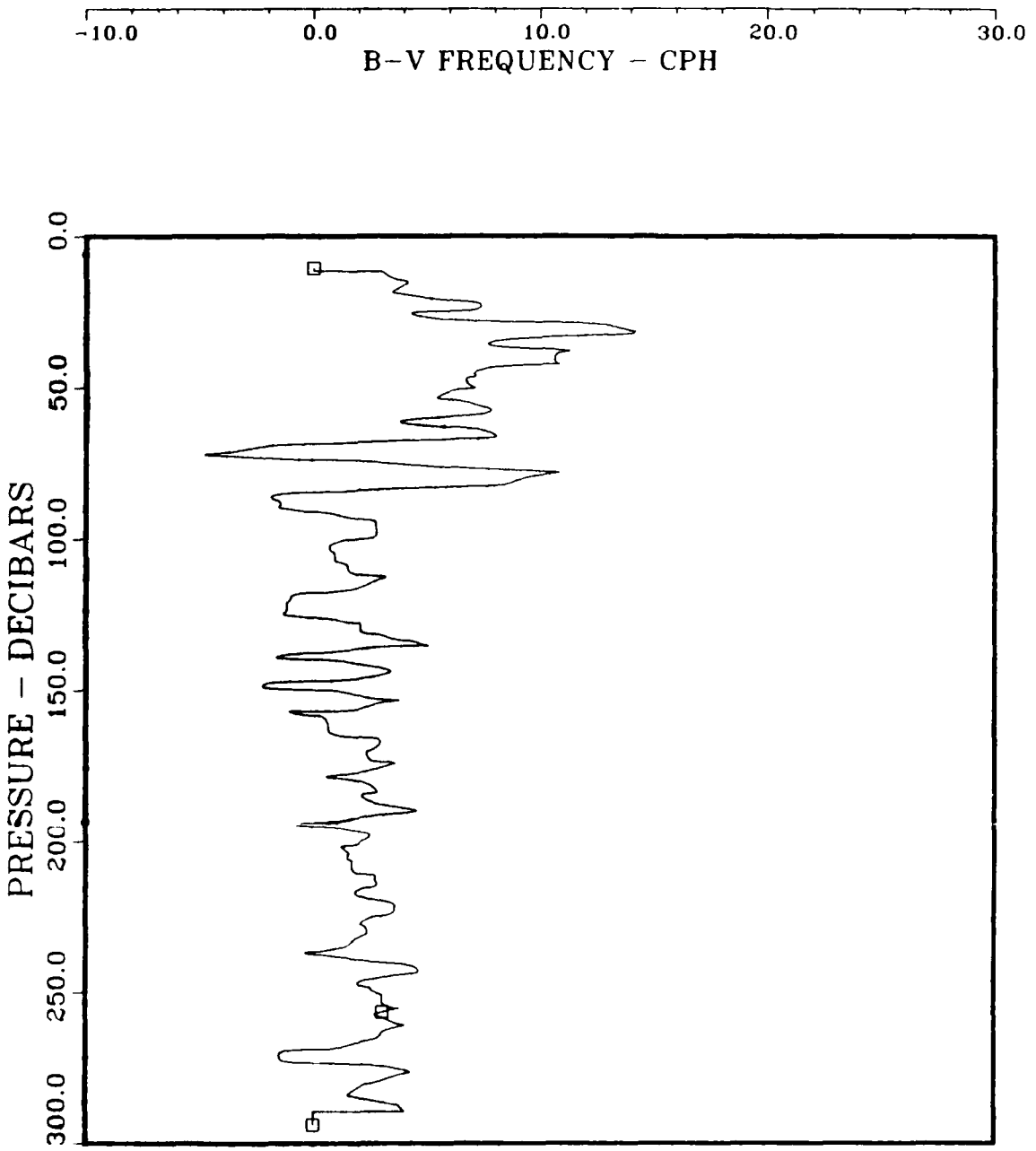
LATITUDE	38.100
LONGITUDE	-72.510

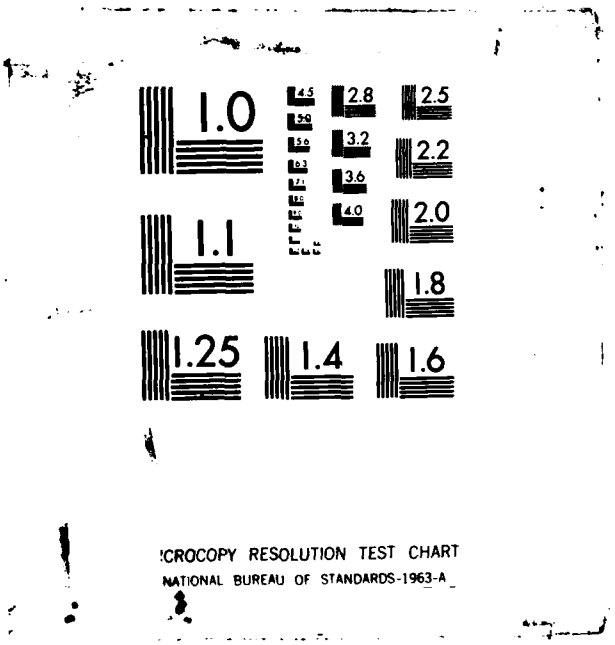
LEGEND
□ = DIRECTION
○ = SPEED

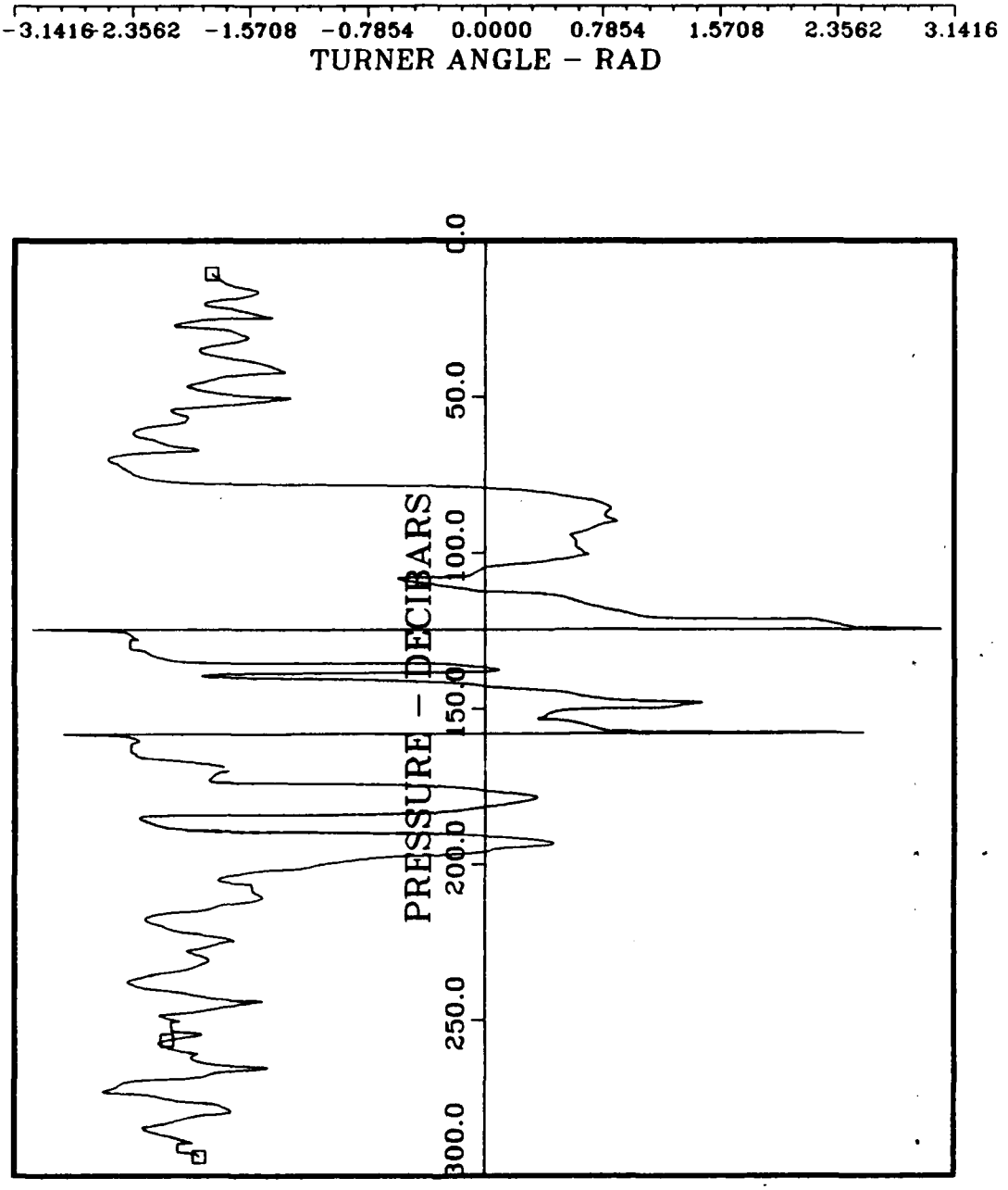


DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
GROUP NUMBER	18
JULIAN DATE	122.9590
LATITUDE	38.100
LONGITUDE	-72.510

AD-A173 332 VCTD (VELOCITY CONDUCTIVITY TEMPERATURE DEPTH) RESULTS: 2/2
GULF STREAM FRONT (U) NAVAL OCEAN RESEARCH AND
DEVELOPMENT ACTIVITY NSTL STATION MS K D SAUNDERS
UNCLASSIFIED JUL 86 NORDA-TN-229 F/G 8/10 NL





DYNAMICS OF CHEMICAL FRONTS - 1985

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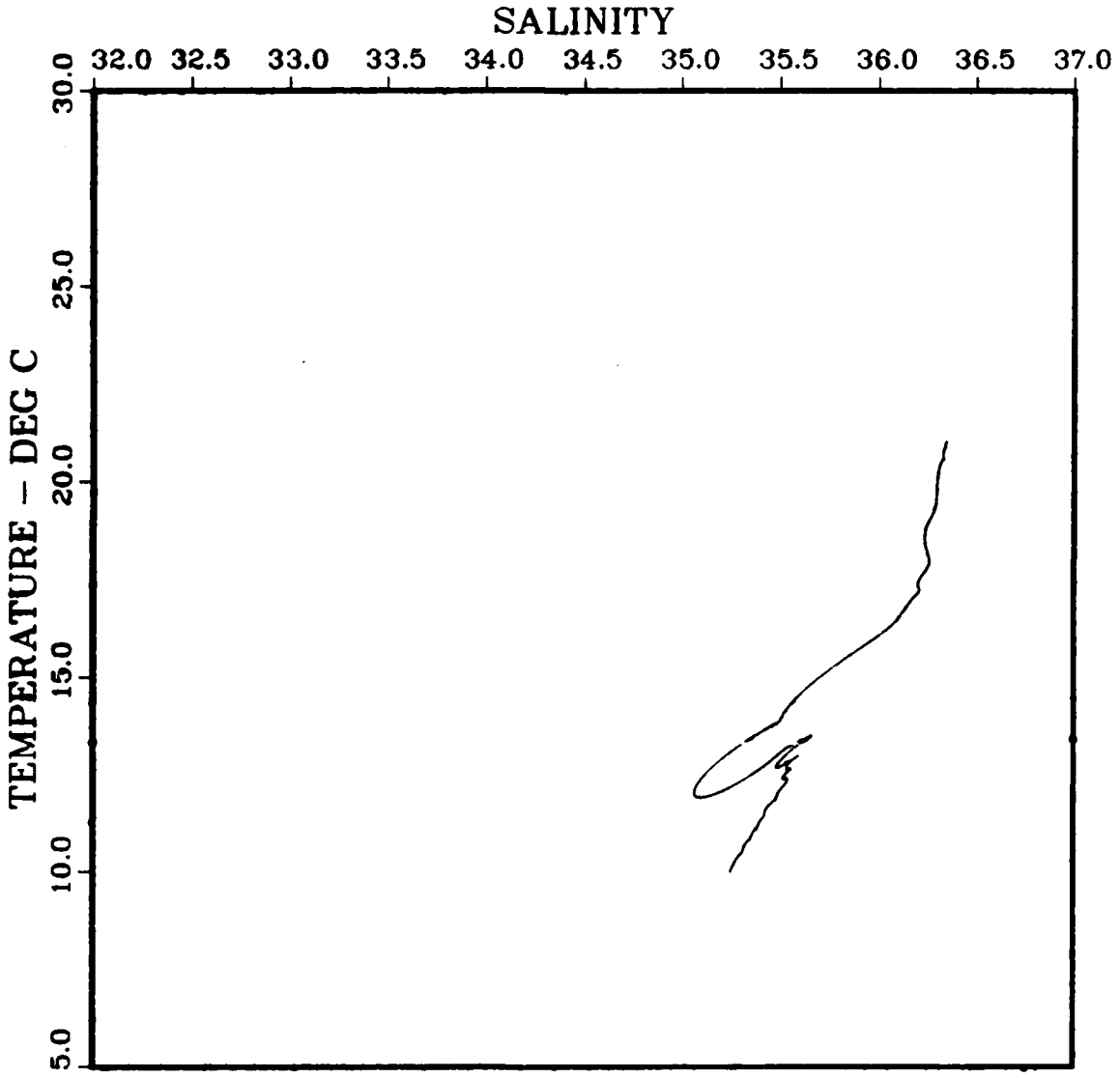

DYNAMICS OF CHEMICAL FRONTS

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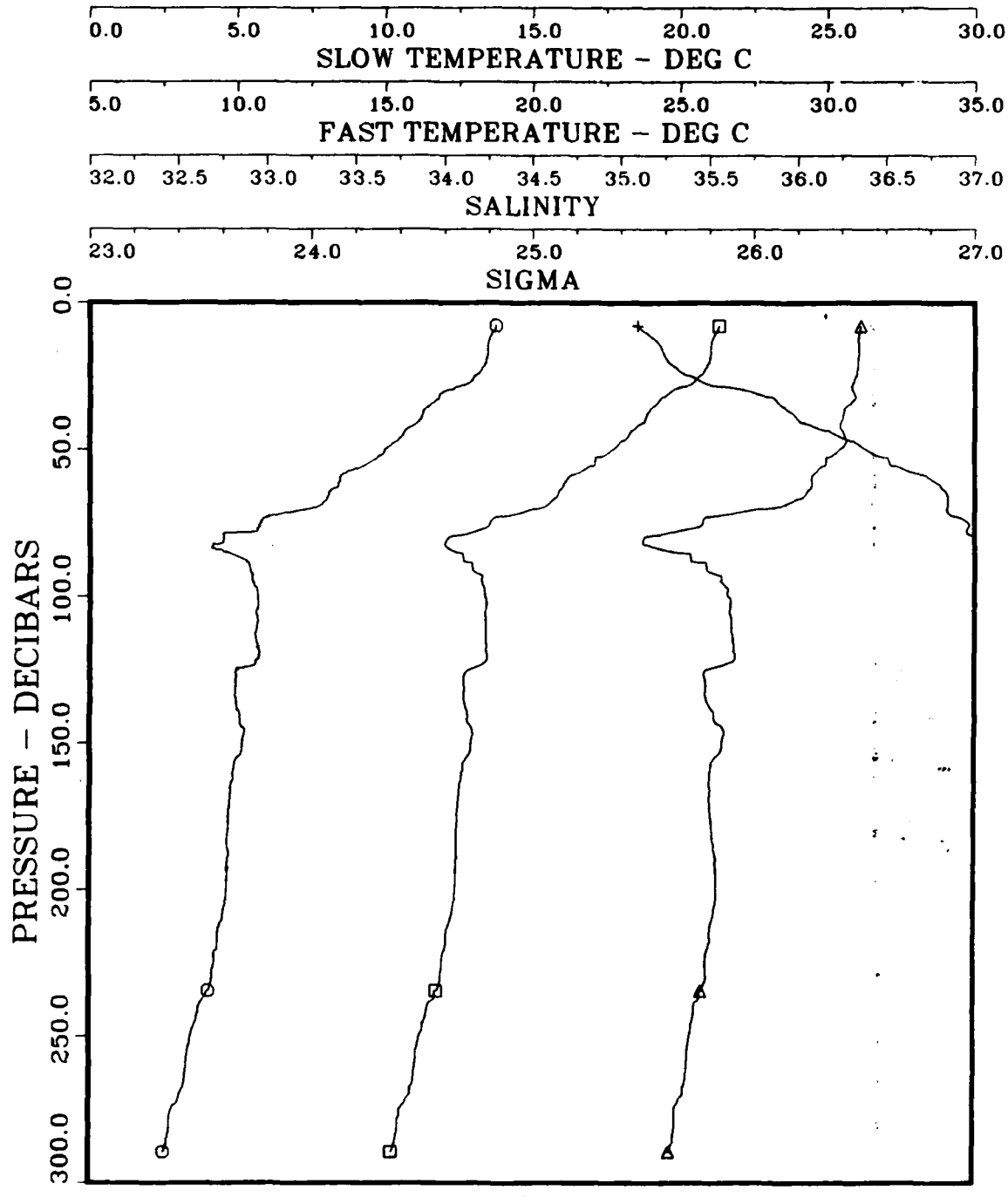

DYNAMICS OF CHEMICAL FRONTS – 1985

STATION	0
GROUP NUMBER	19
JULIAN DATE	125.9670
LATITUDE	38.107
LONGITUDE	−72.497

LEGEND

□ = SLOW TEMPERATURE
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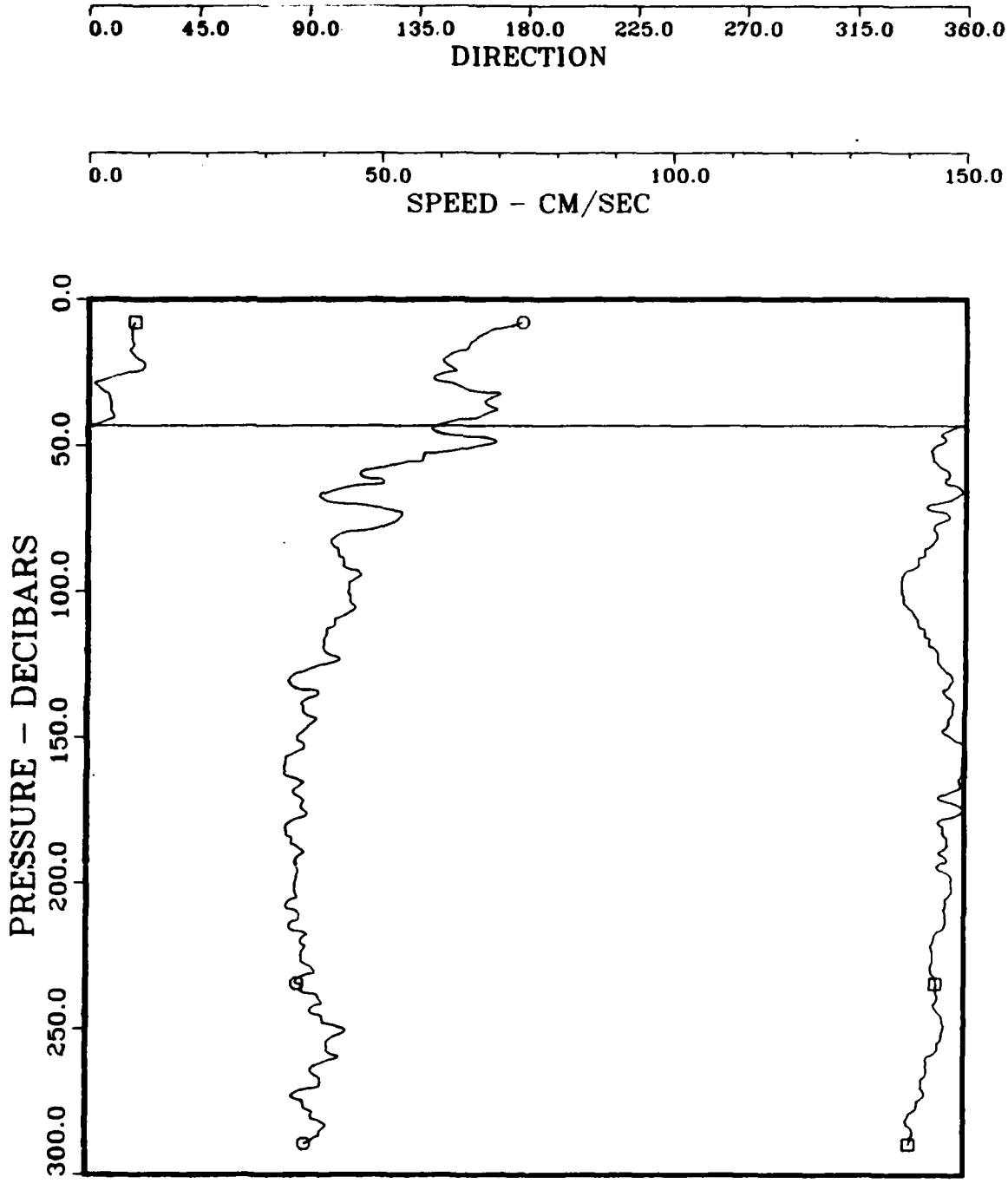
△ = SALINITY
\+ = SIGMA



DYNAMICS OF CHEMICAL FRONTS - 1985

STATION	0
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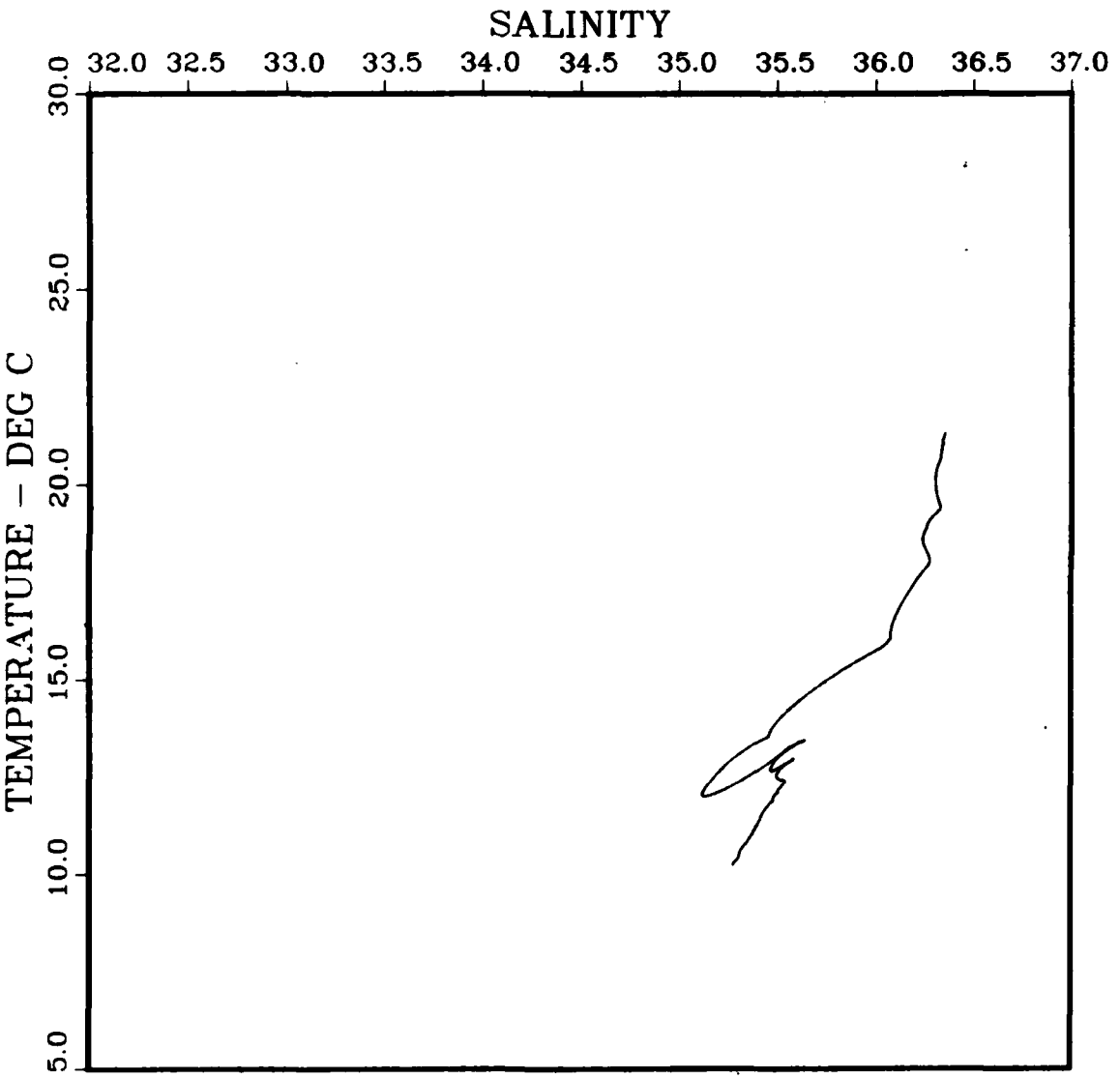
LONGITUDE	-72.497

LEGEND
□ = DIRECTION
○ = SPEED



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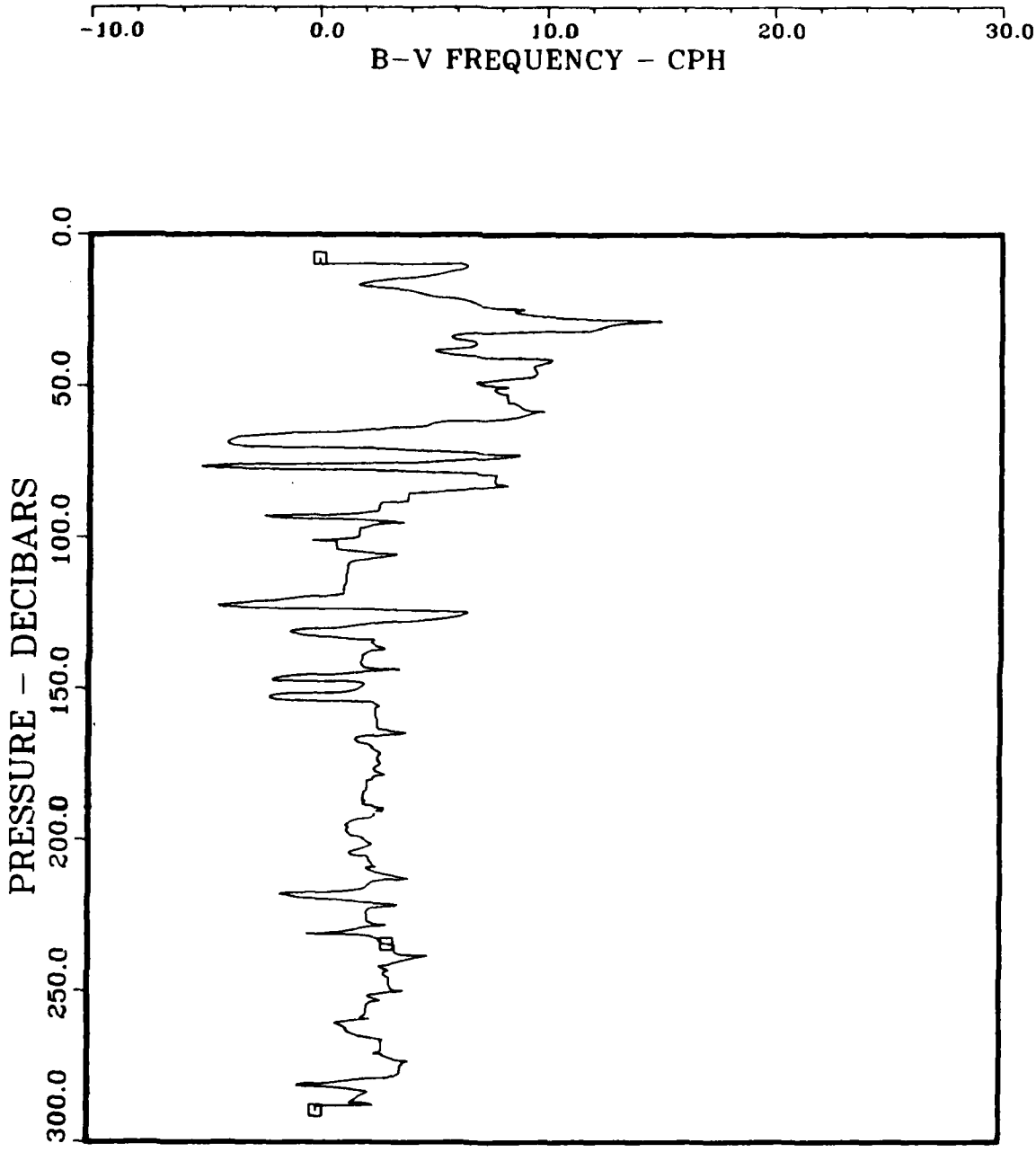

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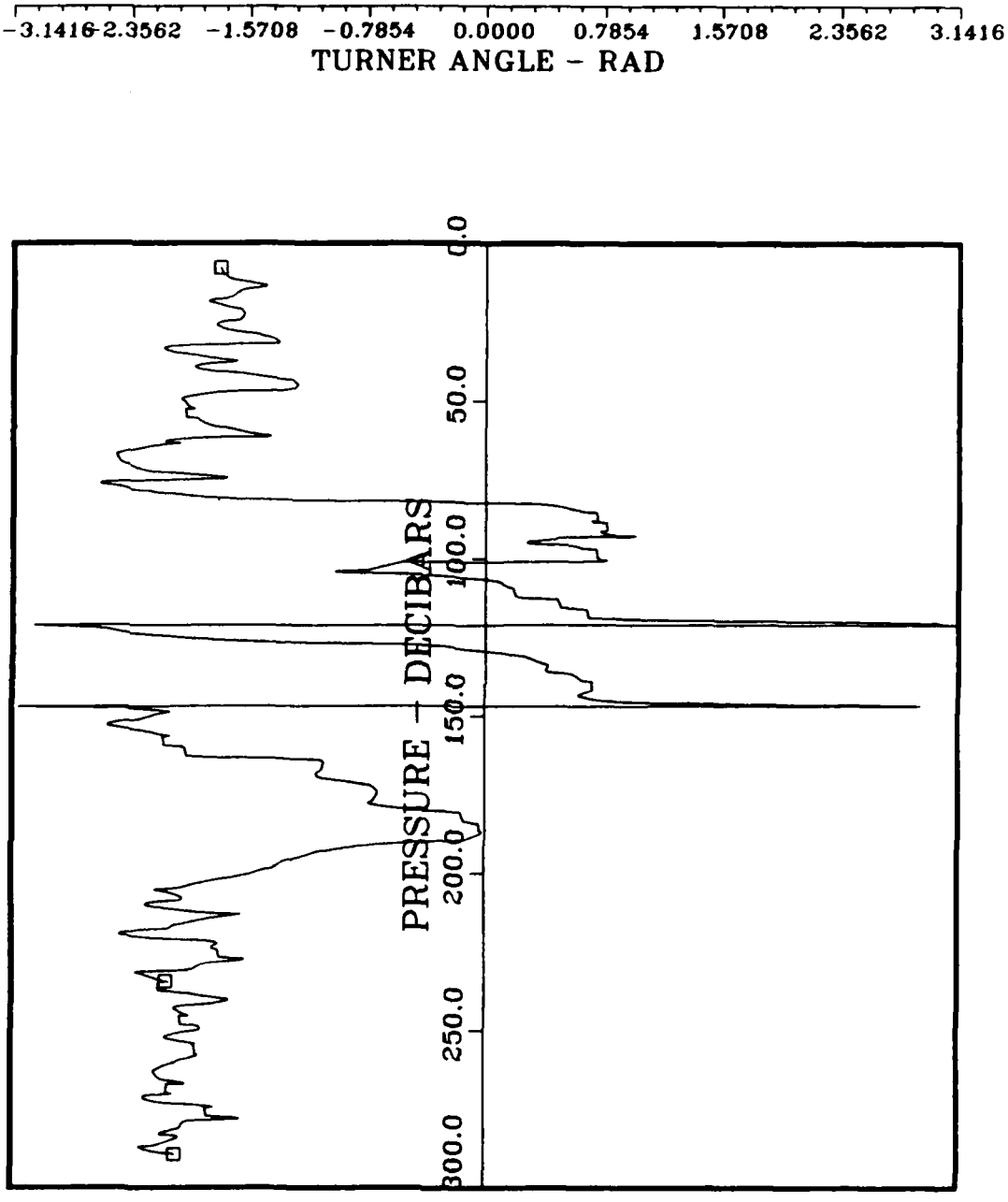

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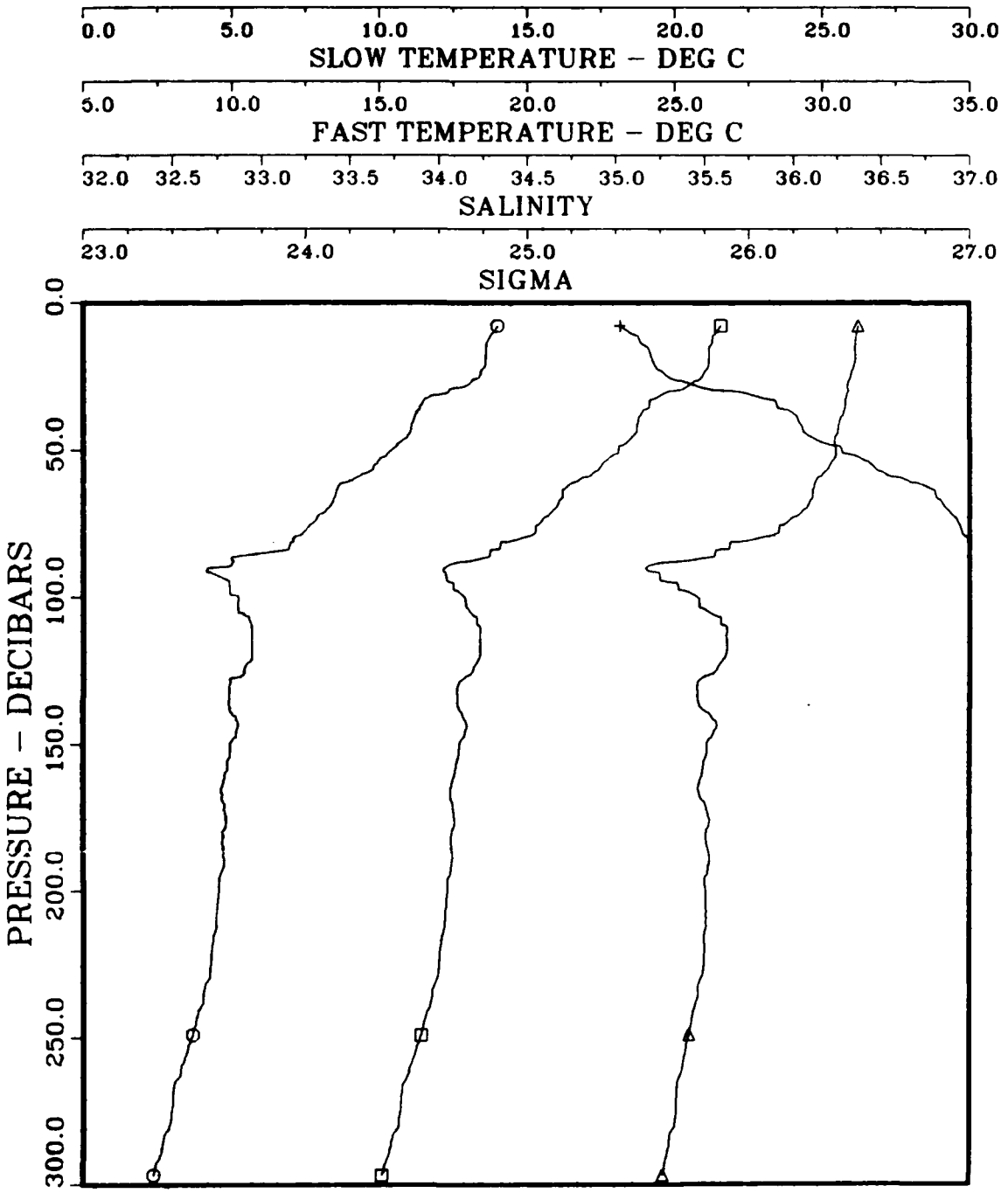

DYNAMICS OF CHEMICAL FRONTS – 1985

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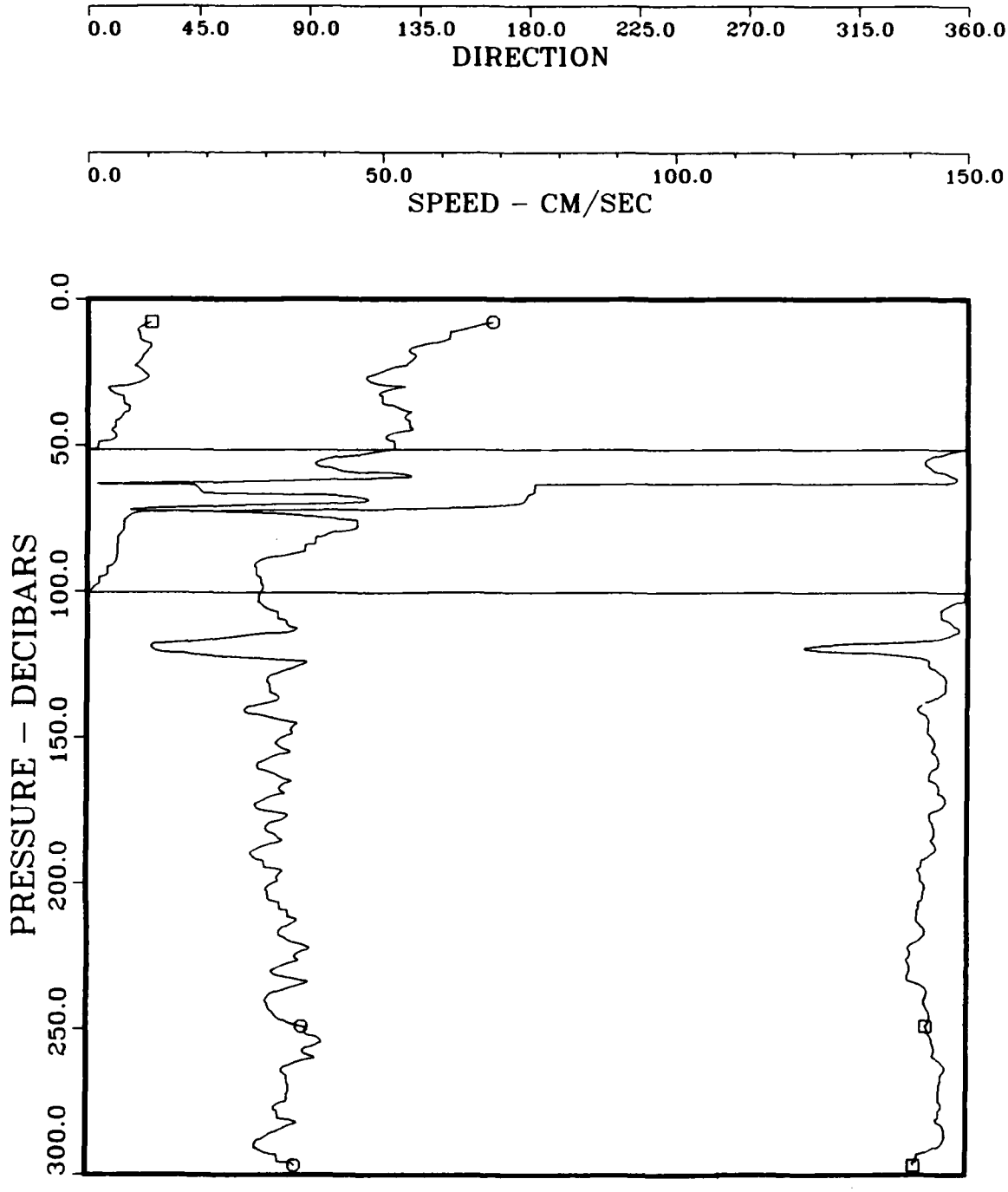

DYNAMICS OF CHEMICAL FRONTS – 1985

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LEGEND
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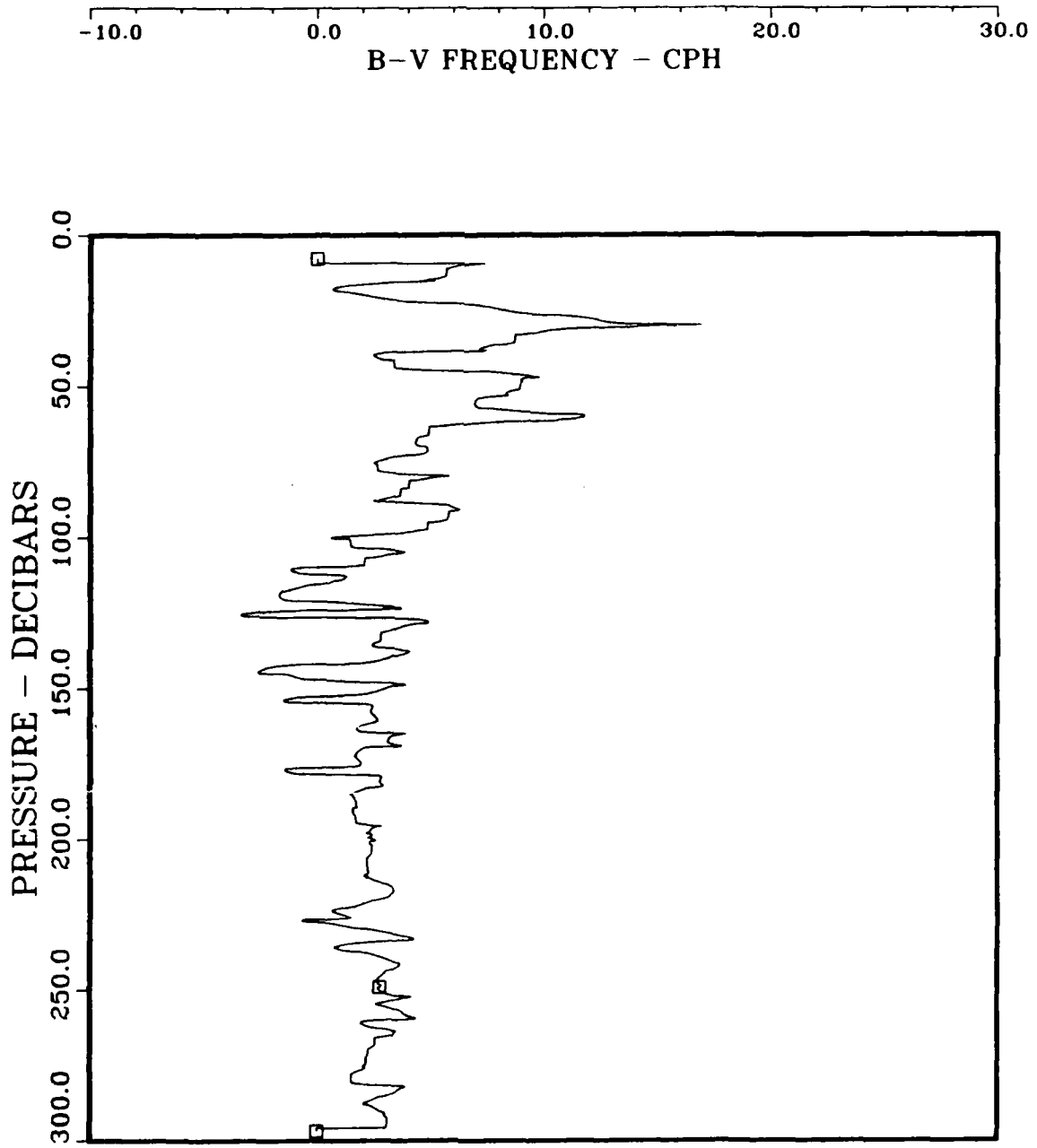

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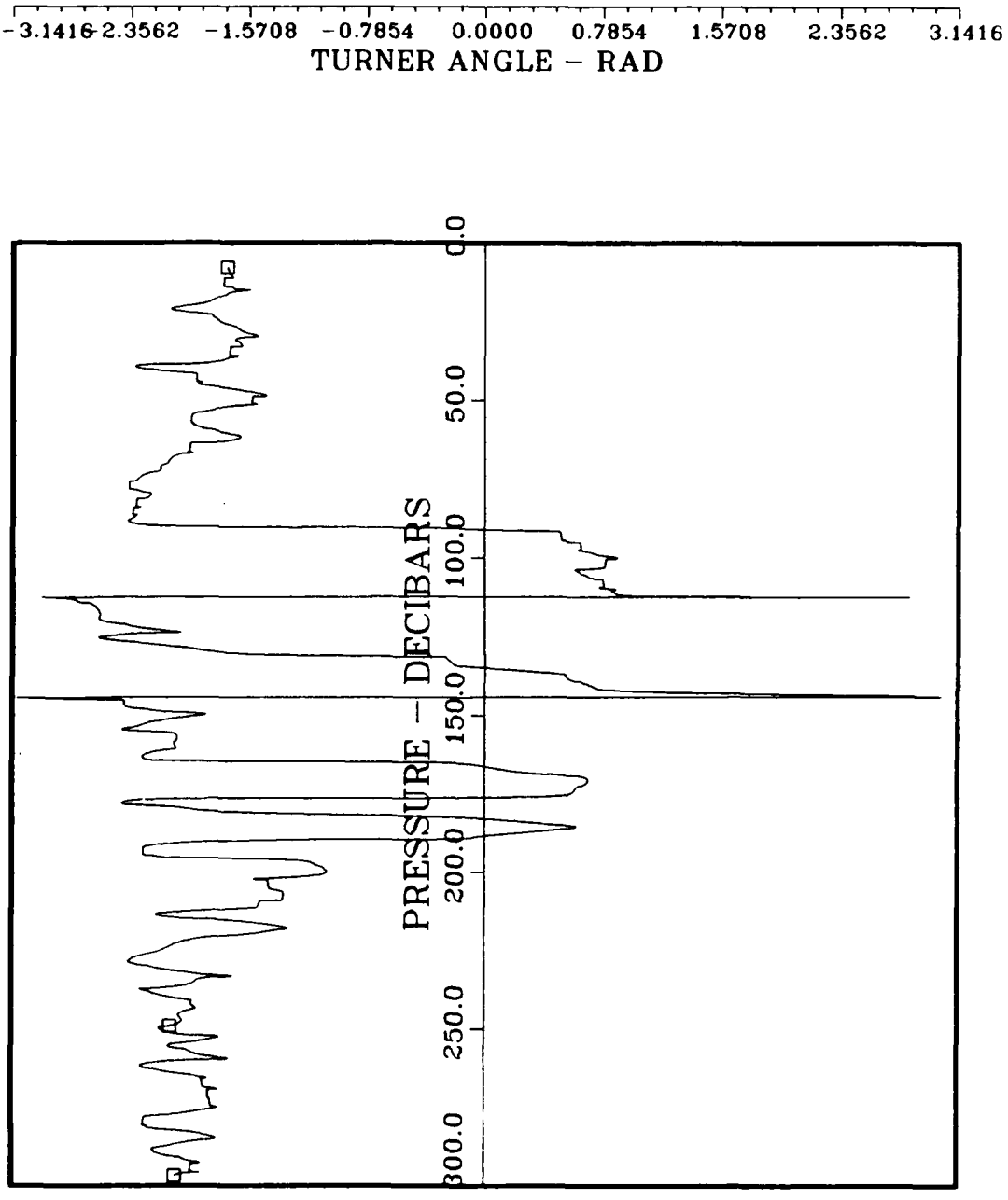

DYNAMICS OF CHEMICAL FRONTS - 1985

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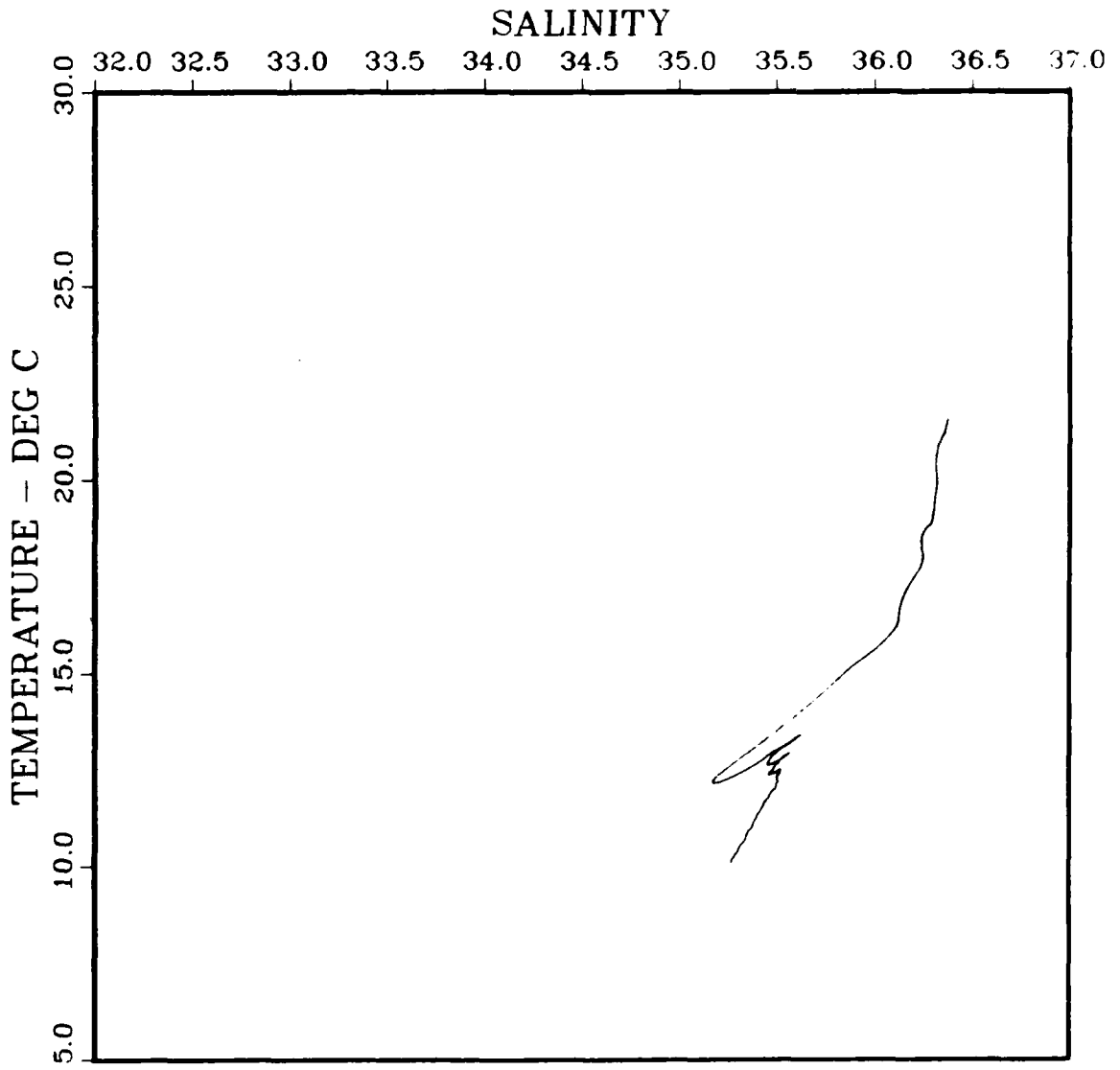

DYNAMICS OF CHEMICAL FRONTS

STATION	0
GROUP NUMBER	20
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SECURITY CLASSIFICATION OF THIS PAGE

ADA173332

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS None
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release, distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) NORDA Technical Note 229	5. MONITORING ORGANIZATION REPORT NUMBER(S) NORDA Technical Note 229
6. NAME OF PERFORMING ORGANIZATION Naval Ocean Research and Development Activity	7a. NAME OF MONITORING ORGANIZATION Naval Ocean Research and Development Activity
6c. ADDRESS (City, State, and ZIP Code) Ocean Science Directorate NSTL, Mississippi 39529–5004	7b. ADDRESS (City, State, and ZIP Code) Ocean Science Directorate NSTL, Mississippi 39529–5004
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Naval Ocean Research and Development Activity 8b. OFFICE SYMBOL (If applicable) Code 331	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) Ocean Science Directorate NSTL, Mississippi 39529–5004	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO. 61153N; PROJECT NO. 03105; TASK NO.; WORK UNIT NO.
11. TITLE (Include Security Classification) VCTD Results: Gulf Stream Frontal Stream Study, 1985, Chemical Dynamics in Ocean Frontal Areas Study	
12. PERSONAL AUTHOR(S) K. D. Saunders	
13a. TYPE OF REPORT Final 13b. TIME COVERED From _____ To _____	14. DATE OF REPORT (Yr., Mo., Day) July 1986 15. PAGE COUNT 111
16. SUPPLEMENTARY NOTATION	
17. COSATI CODES FIELD / GROUP / SUB. GR.	18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) upper ocean, chemical dynamics, ocean fronts

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The first cruise to study chemical (and biological) dynamics in ocean frontal regions was conducted in the spring of 1985 off the east coast of the United States. The NORDA Velocity, Conductivity, Temperature and Depth profiler (VCTD) was employed to collect basic physical oceanographic measurements in the upper ocean. This report presents the data obtained by the VCTD during this cruise.

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